SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, DECEMBER 18, 1908

CONTENTS

Chemical Principles of Soil Classification: PROFESSOR CYRIL G. HOPKINS 857

Extracts from President Roosevelt's Message to the Congress 868

Wolcott Gibbs 875

President Roosevelt's African Trip 876

French Vital Statistics 877

The American Society of Animal Nutrition .. 878

Symposium on Correlation 878

The American Society of Naturalists 879

Scientific Notes and News 880

University and Educational News 884

Discussion and Correspondence:—

The Five Hundredth Anniversary of the University of Leipzig: PROFESSOR CHARLES H. JUDD. *Malaria in the West Indies:* H. A. BALLON. *The Odonata of Mexico:* DR. PHILIP P. CALVERT 884

Quotations:—

Clerical Healing 886

Scientific Books:—

Haug's Traité de Géologie: REGINALD A. DALY. *Barton's Text-book on Sound:* PROFESSOR D. W. HERING. *Curtis on the Nature and Development of Plants:* J. E. KIRKWOOD. *Terry's India-rubber and its Manufacture:* PROFESSOR FRANCIS E. LLOYD 886

Special Articles:—

The Acclimatization of an Alfalfa Variety in Minnesota: CHARLES J. BRAND 891

The Convocation Week Meetings of Scientific Societies 892

Societies and Academies:—

The Biological Society of Washington: M. C. MARSH. *The Philosophical Society of Washington:* R. L. FARIS. *The Northeastern Section of the American Chemical Society:* PROFESSOR FRANK H. THORP 894

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

CHEMICAL PRINCIPLES OF SOIL CLASSIFICATION[1]

IT seems appropriate to preface this paper with some direct quotations from a recent publication of national authority which deal with important questions concerning the chemical principles of the soil.

I read from the "Hearings before the Committee on Agriculture of the United States House of Representatives" under date of January 28, 1908.

Mr. Whitney, Chief of the Bureau of Soils. The investigations of the Bureau of Soils, as to the causes of the deterioration of soils, and the causes that limit crop production, have changed the view-point of the entire world. The recent investigations of the bureau in soil fertility have changed the thought of the world, and several foreign governments, notably the governments of France, of Japan, of South Africa, and of Australia, have taken up these new ideas of soil fertility. (Pp. 428, 429.)

The Chairman. A few years ago the bureau issued a bulletin which was generally construed as meaning to state the proposition that all soils had all the plant food necessary for a maximum growth or crop. The inference, of course, from that was that, such being the case, one soil was as good as another. Now, I would like to know whether the popular conception of that bulletin was wrong or whether the position of the bureau has changed.

Mr. Whitney. That touches on the chemical side of the investigations of the bureau, and we have Mr. Cameron here, who did the work, and possibly he might answer that. (P. 439.)

Mr. Cameron. I would say that the main opposition to this view has been from Dr. Hopkins, from the University of Illinois.

[1] Address before the American Society of Agronomy at Cornell University, Ithaca, New York, July 11, 1908.

Again, the bureau does contend that the soil contains enough plant nutrients to support life and give good crops, for it has been shown scientifically in this country and abroad by many investigators in the past, and by many numerous recent investigations, that all soils contain practically all the common rock-forming minerals. Now, it is a principle of chemistry that when a solvent is brought in contact with a substance, that substance will go into solution until there is a state of equilibrium between the quantity of the substance outside and inside; in other words, we get a saturated solution. If these rock-forming minerals were in all soils we should have the same solution in every soil, and that has been shown to be the case. There are various variations, due to absorption, perhaps of the soil. In the first place, I must ask you gentlemen to remember that the soil and the plant and the water in the soil is moving. The soil grains are constantly moving, and the solution in the soil is constantly moving, and the growing plant is constantly moving. If a plant stops for a moment it dies. The soil solution can not stop for a moment, because it has to be moving all the time. When water falls on the soil part of it runs off the surface, and part of it runs through the surface by gravitation and comes out in the subsoil, and part of it starts and rises as soon as we get sunlight on the surface, and this part comes up in films over and through the finer spaces, and is bringing with it dissolved material from below.

The water that falls and goes through down and out goes rapidly through larger openings, and gets very little of the soluble material, because it is not long in contact with the soil grains. It gets some by reason of the fact that, as we know, our springs and rivers and wells are all soil solutions and carry mineral matter. Now, water rising by capillarity can not get very concentrated because it gets saturated with the minerals, and any excess that is contained in it is thrown out, except in extreme conditions, as in the west, and then we get alkali conditions; but under ordinary humid conditions we can not have an excess of it, and the soil solution is bringing materials from below which the plant gets, and as a matter of fact the most important discovery of the Bureau of Soils in recent years is that plants are feeding on material from the subsoils, far below where the roots go. If this is true, and there are many other arguments in the same line, it is absurd to make an analysis of the surface soil and say that is the soil that the plant is feeding on. It is not. The solution is changing around the plant roots, and it is not the surface material alone on which the plant is feeding.

Now, I am sorry to say that I shall have to make this personal, but in Illinois they have been carrying on a long series of experiments and have been making analyses of the soils, and they stated that in the soils of Illinois there are just so many pounds of phosphorus, and we know what a corn crop will take out of the soil, and therefore we can say that a corn crop will take out so much each year, and these soils will last only a certain number of years—I hesitate to say how many, I do not recollect how many—I think about fifty years. The work we carry on, which was largely given in this bulletin which has been criticized, absolutely overthrows that contention. The soil is changing; it is constantly supplying the material of the soil solution, and we know that soils have lasted thousands and thousands of years, and we have records of soils in India that have lasted two thousand years, and we know they do not wear out, and we gave the explanation why they did not, and why the land did not become a sterile waste, and it naturally aroused a feeling of opposition in the breast of this gentleman.

The Chairman. When you say that all soils contain all the elements of plant food, and there is in those soils at all times a saturated solution of which all these elemnts of plant food make a part, do you not practically say that all soils have all the plant food they need, and that it is at all times available for the plant; or is it not available for the plant if it is in a saturated solution?

Mr. Cameron. Certainly, if there is water enough; if the soil is moist.

The Chairman. Is is not, therefore, a justifiable inference from what you have said, that there is all the time in all soils enough plant food available for plant life?

Mr. Cameron. True; perfectly true as regards the mineral nutrients.

The Chairman. Then I come back again to the question, Why is it necessary, or is it in your judgment necessary, ever at any time to introduce fertilizing material into any soil for the purpose of increasing the amount of plant food in that soil?

Mr. Cameron. Not in my judgment.

The Chairman. Then in your judgment the only reason for the introduction of fertilizers is for the antitoxic effect or the mechanical effect they may have on the soil.

Mr. Cameron. Mainly that, but there are prob-

ably other functions of fertilizers that we know comparatively little about. We know that certain kinds of life, bacteria, molds, can grow in certain solutions of salts, and can not in others. It may be that fertilizers affect them. But all that is an unexplored field, and little is known about it. . . . If you will allow me to say one more word about fertilizers: What are fertilizers? What are the characteristics that a substance must have in order to be a fertilizer? It must be obtainable in large quantities. It must also be cheap. Now, the substances which are used as fertilizers in fertilizing material are substances which can be obtained in large quantities. They are substances, and are the only substances, which we can get hold of that we can get in large quantities that we can get cheap, and with one exception, that is, sodium chloride—common salt. It has not been much used as a fertilizer, because it has not any so-called plant food in it; and yet it has been used in quite a large number of experiments on quite a large scale, and wherever it has been used it has generally been found to be quite a good fertilizer. In the investigations of the bureau we have used pyrogallol. It contains no plant food, but carbon, hydrogen and oxygen, yet, nevertheless, it is a powerful fertilizer; but it can not be obtained cheaply. It is worth over $2 a pound, and nobody would think of recommending it as a fertilizer.

Mr. Pollard. Is that theory about all soils containing all the necessary constituents of plant food generally held by all scientists?

Mr. Cameron. It is accepted by the physical chemists, and by the majority of plant physiologists, and by a large percentage of the agricultural investigators.

Mr. Pollard. Throughout the country?

Mr. Cameron. Throughout this country and Europe; more in Europe than in this country. We have received far more recognition abroad than in this country, but the acceptance of it is growing very much more rapidly. Within the last two years several of us have lectured at the agricultural colleges and have explained these views, and have shown that the criticism which came to Bulletin No. 22, of which I have spoken, was largely incorrect, founded on false premises, and as a result of that we have a large mass of evidence in the form of letters, and other evidence in the fact that a number of agricultural schools are now teaching this, and are using our bulletins as text-books, that these views are accepted everywhere.

Mr. Pollard. You have reached a point where there is no question about the soundness of that view?

Mr. Cameron. I feel absolutely sure of it, and I think there is no question but that 90 per cent. of the scientific men[2] of this country would back that up.

Mr. Pollard. The reason I asked this question is that it seems to me that all of the bureaus—I do not say it with reference to this bureau in particular, but all the bureaus of the various departments at Washington—ought to be very careful about sending out matter of that kind unless they are sure, unless they have proven their ground, because it is likely to mislead and make trouble. That was the reason I asked the question.

Mr. Cameron. There has not been a publication on the subject of soil fertility going out from the Bureau of Soils—and I think I can speak advisedly, for every one has gone through my hands—in which we did not have the experimental proof long before the publication went out, and that this is being recognized I think I can claim by the fact that a number of agricultural colleges in the country are using our bulletins as text-books. I have recently come from a lecture trip extending from Louisiana to Michigan, and I found everywhere that this was being taught, and, as I say, our publications are being used for text-books. (Pp. 445–449.)

Here we have some very plain, concise, and authentic statements of the teaching of the United States Bureau of Soils concerning the chemical principles of soil fertility; and these statements are in harmony with the teaching in past years. Thus on page 64 of Bulletin 22 of the Bureau of Soils, published in 1903, we read:

That practically all soils contain sufficient plant food for good yields, . . . that this supply will be indefinitely maintained.

And on page 59 in the same bulletin were published the following statements:

In truck soils of the Atlantic coast, when 10 or 15 tons of stable manure are annually applied

[2] See report adopted by the Norfolk Convention (1907), of the committee of seven on the president's address before the Association of Official Agricultural Chemists in 1906, published as Illinois Circular 105.

to the acre, in the tobacco lands of Florida and of the Connecticut Valley, where 2,000 or 3,000 pounds of high-grade fertilizers carrying 10 per cent. of potash are used, even where these applications have been continued year after year for a considerable period of time, the dissolved salt content of the soil as shown by this method is not essentially different from that in surrounding fields that have been under extensive cultivation.

In England and in Scotland it is customary to make an allowance to tenants giving up their farms for the unused fertilizers applied in the previous seasons. The basis of this is usually taken at 30 to 50 per cent. for the first year, and at 10 to 20 per cent. for the second year after application, but in the experience of this bureau there is no such apparent continuous effect of fertilizers on the chemical constitution of the soil.

Again, on pages 21 and 22, Farmers' Bulletin 257, published in 1906, we have the following definite statements from Professor Whitney:

There is another way in which the fertility of the soil can be maintained, viz., by arranging a system of rotation and growing each year a crop that is not injured by the excreta of the preceding crop. . . . In other experiments of Laws and Gilbert they have maintained for fifty years a yield of about 30 bushels of wheat continuously on the same soil where a complete fertilizer has been used. . . . With a rotation of crops without fertilizers they have also maintained their yield for fifty years at 30 bushels, so that the effect of rotation has in such case been identical with that of fertilization.

It is not my purpose in this paper to discuss the work[3] and theories and conclusions of the Bureau of Soils, except so far as seems necessary in fixing upon some chemical principles fundamental to maintenance of the fertility of American soils.

Aside from negative factors, including the prevention of injury by disease, insects, weeds, etc., we must recognize six essential and positive factors in crop production:

First, the seed, whose value is governed by kind or variety, by previous selection or breeding, and by inherent vitality and the vigor of growth to be imparted to the young plant.

Second, the home of the plant, or the physical character of the soil, including structure, texture and tilth.

Next, the heat, light and moisture, which influence so markedly the rate of growth, and which can be controlled to a greater or less extent beyond what is done under the normal conditions of crop production.

And lastly, the plant food, a factor of no less importance to crop production than is animal food to the growth of animals.

It can not be said that any one of these factors is the most important, because every one is absolutely essential; but it can be said that of the factors that may be controlled plant food is certainly the most neglected and possibly the least understood, not only by practising farmers, but also by many agricultural teachers and investigators.

Failure to appreciate the importance of the plant-food factor is due in part to the short-sighted view too commonly given to the problem.

The great question that stands before the soil investigator, and before the American people is not how to grow good crops for the next year or even the next generation alone, but how to permanently maintain the fertility of American soils. As soon as we try to plan for permanent systems then we begin to realize the limitations of our plant-food supplies.

Another matter that has led to much confusion and misunderstanding is the common talk of available plant food, as distinct from the total supply, when as a matter of fact there is no definite line of distinction. The question as to the amount of available plant food contained in the soil at any given time is very insignificant in comparison with the question how to make plant food available. The plant food re-

[3] See Illinois Experiment Station circulars 72 and 105, and the Norfolk report (1907) of the committee of seven on the president's address of 1906, Association of Official Agricultural Chemists.

moved from the soil by a crop is not available when the crop is planted, but it must be made available during the growing season.

Plant food is made available by chemical and biochemical processes, of which amnonification and nitrification are among those best understood. The products of organic decomposition and nitrification, including various organic acids, carbonic acid, and nitric acid, are very efficient as solvents for the mineral plant food. Thus, in the conversion of organic nitrogen into nitrate nitrogen for a hundred-bushel crop of corn, the nitric acid formed is alone sufficient to convert seven times as much tricalcium phosphate into monocalcium phosphate as would be required to supply the phosphorus for the same crop; but, of course, it is not limited to this reaction. The presence of calcium carbonate, or some free base, and of oxygen, as in the aeration of the soil by tillage, will assist greatly in the decomposition of the soil and consequent liberation of plant food.

Some inorganic reactions, many organic reactions, and most biochemical reactions are not instantaneous, but long continued, and the rate of reaction is influenced by many factors, including temperature, concentration, aeration, and the presence of catalytic agencies and bacterial food-supplies. Under controlled conditions the length of time required for many such reactions is now determinable; and any soil investigation is incomplete which disregards the presence or absence of active decaying organic matter. It should be understood, too, that this term is not synonymous with humus. Partially decayed peat has no such value as fresh farm manure, clover or other green manures, even though the peat may contain as large or larger amounts of plant food, and produce similar physical effects. The one is in a sense embalmed and very inactive, while definite and continued chemical action is needed and is produced by the fresh materials.

Among the most unsatisfactory and misleading investigations are those from which the use of insoluble plant-food materials has been condemned because they have not responded when applied in the absence of adequate supplies of active organic matter.

Under similar physical conditions the amount of plant food made available during the season varies chiefly with three factors: namely, the presence of calcium carbonate, the supply of decaying organic matter, and the stock or store of fertility contained in the soil.

To supply the soil with decaying organic matter, and with lime if needed, is a necessary part of all extensive agricultural practise, and, with these provided for, the question of the total stock of plant food becomes of first importance. To illustrate this importance we may well consider some well known soils.

The early Wisconsin brown silt loam prairie, one of the commonest soil types in the Illinois corn belt, contains in the plowed soil of an acre (7 inches deep) 1,190 pounds of phosphorus and 36,250 pounds of potassium. For one hundred bushels of corn each year the total supply of phosphorus is sufficient for only seventy years, while the potassium is sufficient for more than seventeen centuries.[4]

In the unglaciated yellow silt loam hill land, the most abundant soil type in seven counties of southern Illinois, the total supply of nitrogen to a depth of 40 inches is sufficient for less than sixty such crops of corn, while the total supply of potassium to the same depth is sufficient for more than ten thousand crops, assuming in both cases that the grain is harvested and the stalks left on the land.

[4] Illinois Experiment Station Bulletin 123.

For a hundred-bushel crop of corn per acre (grain and stalks) the total supply of potassium in our peaty swamp land (seven inches deep) is sufficient for 41 years, while in the yellow-gray silt loam of the Late Wisconsin glaciation it is sufficient for 670 years.

The amounts of plant food referred to represent neither the so-called available plant food nor the acid-soluble portion, but the absolute total contained in the soil strata mentioned. Many other illustrations might be given showing enormous differences in chemical composition of different extensive types. Thus the soil at Lexington, Ky., upon which are located some of the experiment fields of that station, contains from ten to twenty times as much total phosphorus as the soil upon the university farm at Urbana, Illinois.

While the detail soil surveys and the location of boundary lines must be based primarily upon soil formation, topography, physical composition and appearance, certainly no soil classification is complete which ignores the determination of the total supplies of plant food the soils contain.

Even the figures given above may not be of the greatest interest for the production of a few crops, but shall we confine our attention to the possible production of a few more crops?

Among the great material problems of the United States of America there is one that stands supreme and incomparable; namely, to discover and to practise systems of permanent prosperous agriculture. This is a problem that no country has ever solved as we must solve it.

There is permanent agriculture in the valley of the Nile, enriched by the deposits of silt from the annual overflow. There is permanent agriculture in the rice fields of the Ganges Valley in India and the Yangtze-Kiang in China, where the soil is renewed by the frequent torrential overflows or by irrigation with water carrying suspended fertility brought from unmeasured hillsides and mountain slopes.

There is permanent agriculture, in degraded form, in many countries, on sloping hill lands whose worn-out surface soils are washed away in proportion equal at least to the rate of exhaustion of the mineral plant food; where two or three meager crops can always be grown after the land has been turned back to nature for a decade to be restored in some measure by nature's own method of covering the land with vegetation, mold and sod, largely by the aid of legume plants and nitrogen-fixing bacteria.

There is almost permanent agriculture on the black cotton soils of India which occupy extensive level uplands, where the rainfall is all within three months and where during the nine months of drouth the soil opens every few feet with cracks a foot wide and more than ten feet deep into which more or less of the worn-out surface soil falls or is carried by the winds or torrential rains which break the drouth. Here where the natives turn the soil to a depth of two feet or more, cotton, yielding a hundred pounds of lint to the acre, is still grown, after hundreds, and possibly thousands, of years of continuous agriculture.

These deep black cotton soils of India furnish the only example of apparent permanent agriculture on land that is not renewed by overflow or by erosion or by direct applications of plant food; and even here, it may be noted, the product which leaves the farm, cotton lint, carries away but little plant food from the soil, and the average yield is only one tenth of that from our own best cotton lands.

No other country has yet solved for us America's first great material problem—to discover and to practise systems of perma-

nent agriculture—for the wheat belt, and for the corn belt, and for the cotton belt; but we believe the problem is being solved for the state of Illinois—not by theories or hypothesis, but by mathematical and chemical facts, supported by actual demonstrations in the field and on the farm in all parts of the state. So far as I have been able to learn, the oldest soil experiment fields in the United States are in Illinois, with an authentic record and history of nearly a third of a century; and extensive investigations are in progress on subsequently established fields. Lands that were once poor are becoming rich—rich in materials absolutely required to make crops. Where 12 bushels of wheat were commonly grown, 30 bushels are now produced, and in both cases the same crop rotation is practised, wheat being grown but once in four years on the same field. Where without soil treatment, in the best rotation, corn yields but 50 or 60 bushels, the present average yield on treated land is from 90 to 100 bushels, under the same crop rotation. Where clover commonly fails or yields less than a ton of hay to the acre, two to three tons are now produced on properly treated land.

How is this accomplished? Simply by knowing the chemistry of the air and of the soil and by applying that knowledge mathematically to agriculture, by drawing upon these natural sources for every element of plant food which they contain in inexhaustible amount, and by supplying from other sources such elements as it is mathematically impossible for the air or soil to furnish indefinitely. Where the soil contains a very limited amount of any element of plant food not present in the atmosphere, that element is supplied not in small quantities of high-priced soil stimulants as in the so-called "complete fertilizers" that have helped to ruin much of the lands of the eastern and southern states, but in the positive addition of plant food in larger amounts than are required for the largest crops, so that the soil becomes richer, actually and mathematically, even though large crops are removed from the land. The fertilizers thus used are not artificial, but natural, and chiefly in the same form as existed originally in our naturally rich virgin soil.

Chief among the materials that we have found it necessary to use are fine-ground phosphate rock and natural limestone, together with abundance of legume crops, which must be returned to the land either directly or in manure.

We have absolutely permanent supplies of nitrogen in the air, to be secured as needed by means of clover and other legume crops, and for our system of farming we have in our common soils almost unlimited supplies of potassium and of the other less important essential mineral elements, which may be liberated as needed by means of decaying organic matter; so that with these, as with our inexhaustible limestone deposits, we are agriculturally independent. But, as the result of hundreds of analyses[5] of soils and crops, we know that the average common prairie and upland timber soils of Illinois contain about 2,000 pounds of total phosphorus per acre-foot, and with equal chemical and mathematical accuracy we know that a hundred such crops as we are now growing on our richest and best fertilized lands remove from the soil about 2,000 pounds of phosphorus. A thousand years of such cropping would require every pound of phosphorus contained in our average soil to a depth of ten feet.

Whatever we might wish to believe, we can not alter these absolute facts. We need to conserve our supplies of phosphorus, whether in the deposits of natural phosphate rock or in our farm lands or in

[5] Illinois Experiment Station Bulletin 123.

the products of the soil, as in grain and bone and animal fertilizers. Of course, if we raise crops only half as large as are possible under our normal conditions of rainfall and sunshine, then our draft upon the soil is so much less; and if we return in farm fertilizers a part of the fertility removed in crops, we may still farther postpone the day when the soil will refuse to honor the drafts we try to make.

It would seem not only important and appropriate, but especially necessary, to emphasize these facts, if from the position of highest agricultural authority should continue the wide-spread promulgation of the remarkable theory:

> That practically all soils contain sufficient plant food for good crop yields, that this supply will be indefinitely maintained;[6] that there is another way in which the fertility of the soil can be maintained, viz., by arranging a system of rotation and growing each year a crop that is not injured by the excreta of the preceding crop;[7] and that it is not necessary ever at any time to introduce fertilizing material into any soil for the purpose of increasing the amount of plant food in that soil.[8]

In a public address before the American Society of Agronomy upon the Chemical Principles of Soil Classification, I can not conscientiously omit a protest against this teaching. That crop yields are increased by application of plant-food materials is universally and absolutely known, and this fact is of course admitted by all; but the mere admission of this absolute fact does not relieve in the least the serious menace to American agriculture of the official teaching that such applications are entirely unnecessary, that it is never necessary at any time to introduce fertilizing material into any soil for the purpose of increasing the amount of plant food in that soil.

Under this doctrine farmers are taught to use, and to depend upon, any means or method that will stimulate crop yields, with no purpose or thought of maintaining or increasing the plant food in the soil. It is held that crop rotation is sufficient to maintain the fertility of the soil, and that powerful soil stimulants, such as quicklime and salt, will also accomplish this end. On the other hand, the positive addition of valuable plant food to the soil in systems of permanent soil enrichment is distinctly discouraged, such practise being denounced as wholly unnecessary. Indeed, farmers are strongly encouraged to rob their land of its fertility to the greatest possible extent and to make no return of plant food to the soil.

Furthermore, under this doctrine there is every inducement to sell, for a trifle, not only the million tons of phosphate rock now being annually exported from this country, but still larger and more exhaustive amounts of this tremendously valuable and absolutely necessary natural resource whose conservation is of the gravest importance to the United States, and of the most far-reaching consequence to our national prosperity.

Indeed, this is a matter of such vital concern to this country, and especially to the great agricultural states, that it can not rightly be ignored; for, if these unsupported theories are generally accepted by the farmers of the United States, and if the future, in harmony with all the past, only proves that crop rotation will not permanently maintain the fertility of the soil, and that the use of soil stimulants only leads to ultimate land ruin, then who shall estimate what proportion of the farms that

[6] From page 64 of Bulletin 22 of the Bureau of Soils, published in 1903.

[7] From page 21 of Farmers' Bulletin 257, by Milton Whitney, Chief of the Bureau of Soils, published in 1906.

[8] From the Hearings before the Committee on Agriculture of the House of Representatives, on January 28, 1908, in the committee's discussion with leading members of the Bureau of Soils.

are now prosperous and capable of inaugurating and supporting systems of profitable improvement leading to permanent prosperity, would, under fifty years' struggle to practise this theory, become too completely impoverished ever to redeem themselves from ultimate land ruin?

Surely we should consider the inadequate foundation of this widely promulgated hypothesis, that *practically all soils contain sufficient plant food for good crop yields,* that *this supply will be indefinitely maintained,* that *crop rotation alone will maintain the fertility of the soil,* and that *it is not necessary ever at any time to introduce fertilizing material into any soil for the purpose of increasing the amount of plant food in that soil.*

The one theory advanced in support of this remarkable doctrine is based upon the assumption that sufficient amounts of soluble plant food are brought up from the lower subsoils by the rise of capillary water to constantly replace the plant food removed by the largest crops, and thus to permanently maintain the fertility of the surface soil. (See hearings before the Committee on Agriculture, January 28, 1908.)

It is well known that soluble materials are brought from the subsoil to the surface by capillary moisture in semi-arid countries where the water leaves the soil, not by drainage, but only by evaporation, and also that there is some little tendency in this direction in humid countries, especially in times of partial drouth, but for all normal agricultural conditions this movement is insignificant compared with the actual losses of plant food in drainage water and in crops removed.

This truth is already fully established, not only by the fact that underground drainage waters always carry off some soluble plant food, but also by the fact that in humid regions the surface soils are not richer, but much poorer, than the lower subsoils—in potassium, in magnesium, in lime, and in all other constituents that dissolve in the soil waters and that do not accumulate in the humus from plant residues. Indeed, the surface even of normal virgin soils is almost invariably markedly poorer in such mineral constituents than are the corresponding lower subsoils; so that in all countries the common method employed by geologists for ascertaining the relative age of different soils is to determine the depth of soil to which some mineral constituent, as lime, has been leached out. It is everywhere recognized, both in science and in practise, that more or less of the plant food applied to soils is lost by leaching.

One of the most potent factors in the formation of all residual soils is the process of leaching. Thus, from the leaching of disintegrated rock have soils been formed. Limestone soils were originally impure limestone rock from which a very large percentage of the original rock material has been removed by leaching. No geological fact is better established or more universally recognized. From 75 to 90 per cent. of the original rock formation is not infrequently removed by leaching in the making of residual soils.

Under ordinary circumstances, I would no more think of taking up the valuable time of this society by citing proofs of the marked and continuous losses of plant food by leaching from the surface soil, than I would to cite the proofs that the earth is round, for the one fact is as well established as the other; but under the extraordinary circumstances of the confident promulgation from the position of highest agricultural authority of the theory that the fertility of American soils will be permanently maintained by the rise of plant food in capillary moisture, I feel justified in bur-

dening you with one illustration of the hundreds that might be given.

The soil of the famous Rothamsted Experiment Station is underlain with a bed of calcium carbonate, in the form of chalk, at a depth of eight feet or more. Here, then, is certainly the ideal condition with an immense supply of lime in the lower subsoil, "far below where the roots go," from which there should be an abundance carried up to the surface by capillary moisture, in accordance with the theory that "there is a steady tendency toward an accumulation of dissolved mineral matter at the surface."[9]

Now what do we find the truth to be? Is there a steady tendency toward the accumulation of lime in the surface soil at Rothamsted?

The existing information is very complete on this point. During a period of 40 years, from 1865 to 1905, large numbers of analyses have been made of the Rothamsted soils. During that time, according to Director Hall[10] and Dr. Miller, from nine different plots on Broadbalk Field there have been the following losses of calcium carbonate per acre per annum from the surface 9 inches:

	Pounds
From Plot 2*b*	590
From Plot 3	800
From Plot 5	878
From Plot 6	1,174
From Plot 7	1,010
From Plot 8	1,174
From Plot 9	564
From Plot 10	1,045
From Plot 11	1,429

The truth is that instead of an accumulation at the surface, there has been a large loss of calcium carbonate from every plot, the total loss in 40 years ranging from 11 tons to 28 tons per acre, and varying with the manures applied and the crops produced.

Furthermore, from eight different plots on Hoos Field there have been the following average yearly losses:

	Pounds
From Plot 1*O*	1,185
From Plot 4*O*	723
From Plot 1*A*	793
From Plot 4*A*	750
From Plot 1*N*	772
From Plot 4*N*	554
From Plot 1*C*	750
From Plot 7–2	848

Here, again, every plot reported has sustained a large loss, the average being about the same as for Broadbalk Field. The investigations reported also include Agdell Field and Little Hoos Field, both of which have likewise suffered loss in about the same amount as Broadbalk and Hoos.

Surely with this common knowledge of uncompensated loss by leaching in all normal humid sections, we dare not base our definite plans for systems of permanent agriculture upon a theory that by the rise of capillary water plant food is brought from the lower subsoils sufficient to meet the needs of large crops and to maintain the fertility of the surface soil in all places and for all time; and yet this is the one foundation upon which the teaching of the Bureau of Soils rests concerning permanent supplies of plant food, and is, according to Dr. Cameron, "the most important discovery of the Bureau of Soils in recent years."

In 1839 the following statement was made in Sir Humphry Davy's "Agricultural Chemistry" (p. 343):

> Some effects attributed to exhaustion of soil may be owing to excretions from roots, injurious to the plants which have yielded them, and yet beneficial to other kinds of plants; in one instance acting the part of a poison, in the other of a manure.

[9] Cameron, in "Cyclopedia of American Agriculture" (1907), Vol. I., p. 370.

[10] *Proceedings of the Royal Society* (1905), Vol. 77.

Other literature is also cited in this ancient volume, showing that the investigation of this problem of toxic excreta from plant roots was a live question seventy years ago.

That crop rotation has great value has been recognized for centuries and nowhere has its importance been more clearly shown than on the oldest soil experiment fields at the University of Illinois, where, after 30 years of crop rotation, 58 bushels of corn per acre are still produced as an average of the last three crops, while less than 25 bushels is the average for the same three years on land where corn has been grown every year for 30 years. The value of crop rotation must be attributed to the assistance thus rendered in retarding the development and multiplication of injurious insects and fungous or bacterial diseases and possibly in avoiding injury from poisonous plant excreta, and to the addition of organic matter, which supplies some nitrogen and hastens the liberation of other essential elements; but the effect of crop rotation is always to reduce, and never to augment, the total supply of mineral plant food in the soil and subsoil.

The bank must receive deposits as well as honor checks and drafts; the merchant must purchase stock as well as sell goods; and likewise, if we are to remove continually plant food from the soil in large crops, we must give back to the soil with intelligence based at least upon the mathematical facts.

This is truly the age of science, but science means knowledge; it does not mean theory or hypothesis. One dollar taken from 100 dollars leaves not 100 dollars, but only 99 dollars. This is a scientific fact which no theory or hypothesis can nullify. Likewise when a crop removes 20 pounds of phosphorus from the soil it leaves that soil 20 pounds poorer in phosphorus than before the crop was grown. The rotation of crops or the application of salt or some other stimulant may liberate another 20 pounds of phosphorus from the soil and thus enable us to grow another crop the next year, and possibly this may be repeated for several or many years, but meanwhile the total supply of phosphorus in the soil is growing smaller and smaller year by year, until ultimately neither crop rotation nor soil stimulants can liberate sufficient phosphorus from the remaining meager supply to meet the needs of profitable crops.

It is certainly safe teaching and safe practise to return to the soil as much or more than we remove of such plant-food elements as are contained in the soil in limited amounts when measured by the actual requirements of large crops during one lifetime.

The average prairie soil of more than 20 counties in southern Illinois contains such a limited supply of phosphorus that 60 such crops as we raise on our best treated land in the corn belt would require every pound of phosphorus contained in a 12-inch stratum of the southern Illinois soil; while two centuries of such crops, if they could be grown, would completely exhaust the soil of its phosphorus content to a depth of 40 inches.

These are the oldest prairie soils in the state, both agriculturally and geologically. They are also the poorest prairie soils in the state in the total supply of every valuable plant-food element. In harmony with universal experience, these soils do not improve, but continually deteriorate with time and use where no adequate return of plant food is made. These soils are not renewed by deposits from overflow or by the removal of the depleted surface by erosion, and without the positive addition of deficient plant food the future condition of these soils must be the same as the present con-

dition of much of the level upland plains of populous China, where now exist soil areas hundreds of square miles in extent that are absolutely depopulated, the restoration of which has been called "The Problem of China."

Permanent agriculture is the only structure upon which the future prosperity of the American nation can be secured, and the absolutely essential foundation of permanent agriculture is the fertility of the soil.

Cyril G. Hopkins
University of Illinois

EXTRACTS FROM PRESIDENT ROOSEVELT'S MESSAGE TO THE CONGRESS

If there is any one duty which more than another we owe it to our children and our children's children to perform at once, it is to save the forests of this country, for they constitute the first and most important element in the conservation of the natural resources of the country. There are, of course, two kinds of natural resources. One is the kind which can only be used as part of a process of exhaustion; this is true of mines, natural oil and gas wells and the like. The other, and of course ultimately by far the most important, includes the resources which can be improved in the process of wise use; the soil, the rivers and the forests come under this head. Any really civilized nation will so use all of these three great national assets that the nation will have their benefit in the future.

Just as a farmer, after all his life making his living from his farm, will, if he is an expert farmer, leave it as an asset of increased value to his son, so we should leave our national domain to our children, increased in value and not worn out. There are small sections of our own country, in the east and in the west, in the Adirondacks, the White Mountains and the Appalachians, and in the Rocky Mountains, where we can already see for ourselves the damage in the shape of permanent injury to the soil and the river systems which comes from reckless deforestation. It matters not whether this deforestation is due to the actual reckless cutting of timber, to the fires that inevitably follow such reckless cutting of timber or to reckless and uncontrolled grazing, especially by the great migratory bands of sheep, the unchecked wandering of which over the country means destruction to forests and disaster to the small homemakers, the settlers of limited means.

Shortsighted persons, or persons blinded to the future by desire to make money in every way out of the present, sometimes speak as if no great damage would be done by the reckless destruction of our forests. It is difficult to have patience with the arguments of these persons. Thanks to our own recklessness in the use of our splendid forests, we have already crossed the verge of a timber famine in this country, and no measures that we now take can, at least for many years, undo the mischief that has already been done. But we can prevent further mischief being done, and it would be in the highest degree reprehensible to let any consideration of temporary convenience or temporary cost interfere with such action, especially as regards the national forests which the nation can now, at this very moment, control.

All serious students of the question are aware of the great damage that has been done in the Mediterranean countries of Europe, Asia and Africa by deforestation. The similar damage that has been done in eastern Asia is less well known. A recent investigation into conditions in North China by Mr. Frank N. Meyer, of the Bureau of Plant Industry of the United States Department of Agriculture, has incidentally

furnished in very striking fashion proof of the ruin that comes from reckless deforestation of mountains, and of the further fact that the damage once done may prove practically irreparable.

So important are these investigations that I herewith attach as an appendix to my message certain photographs showing present conditions in China. They show in vivid fashion the appalling desolation, taking the shape of barren mountains and gravel and sand covered plains, which immediately follows and depends upon the deforestation of the mountains. Not many centuries ago the country of northern China was one of the most fertile and beautiful spots in the entire world and was heavily forested.

We know this not only from the old Chinese records, but from the accounts given by the traveler Marco Polo. He, for instance, mentions that in visiting the provinces of Shansi and Shensi he observed many plantations of mulberry trees. Now there is hardly a single mulberry tree in either of these provinces, and the culture of the silkworm has moved further south, to regions of atmospheric moisture. As an illustration of the complete change in the rivers, we may take Polo's statement that a certain river, the Hun Ho, was so large and deep that merchants ascended it from the sea with heavily laden boats; to-day this river is simply a broad sandy bed, with shallow, rapid currents wandering hither and thither across it, absolutely unnavigable.

But we do not have to depend upon written records. The dry wells, and the wells with water far below the former water mark, bear testimony to the good days of the past and the evil days of the present. Wherever the native vegetation has been allowed to remain, as, for instance, here and there around a sacred temple or imperial burying ground, there are still huge trees and tangled jungle, fragments of the glorious ancient forests. The thick, matted forest growth formerly covered the mountains to their summits. All natural factors favored this dense forest growth, and as long as it was permitted to exist the plains at the foot of the mountains were among the most fertile on the globe, and the whole country was a garden.

Not the slightest effort was made, however, to prevent the unchecked cutting of the trees or to secure reforestation. Doubtless for many centuries the tree-cutting by the inhabitants of the mountains worked but slowly in bringing about the changes that have now come to pass; doubtless for generations the inroads were scarcely noticeable. But there came a time when the forest had shrunk sufficiently to make each year's cutting a serious matter, and from that time on the destruction proceeded with appalling rapidity; for, of course, each year of destruction rendered the forest less able to recuperate, less able to resist next year's inroad.

Mr. Meyer describes the ceaseless progress of the destruction even now, when there is so little left to destroy. Every morning men and boys go out armed with mattox or axe, scale the steepest mountain sides, and cut down and grub out, root and branch, the small trees and shrubs still to be found. The big trees disappeared centuries ago, so that now one of these is never seen save in the neighborhood of temples, where they are artificially protected; and even here it takes all the watch and care of the tree-loving priests to prevent their destruction.

Each family, each community, where there is no common care exercised in the interest of all of them to prevent deforestation, finds its profit in the immediate use of the fuel which would otherwise be used by

some other family or some other community. In the total absence of regulation of the matter in the interest of the whole people, each small group is inevitably pushed into a policy of destruction which can not afford to take thought for the morrow. This is just one of those matters which it is fatal to leave to unsupervised individual control. The forests can only be protected by the state, by the nation; and the liberty of action of individuals must be conditioned upon what the state or nation determines to be necessary for the common safety.

The lesson of deforestation in China is a lesson which mankind should have learned many times already from what has occurred in other places. Denudation leaves naked soil; then gullying cuts down to the bare rock; and meanwhile the rock waste buries the bottom lands. When the soil is gone, men must go; and the process does not take long.

This ruthless destruction of the forests in northern China has brought about, or has aided in bringing about, desolation, just as the destruction of the forests in central Asia aid in bringing ruin to the once rich central Asian cities; just as the destruction of the forests in northern Africa helped toward the ruin of a region that was a fertile granary in Roman days. Short-sighted man, whether barbaric, semi-civilized, or what he mistakenly regards as fully civilized, when he has destroyed the forests, has rendered certain the ultimate destruction of the land itself.

In northern China the mountains are now such as are shown by the accompanying photographs, absolutely barren peaks. Not only have the forests been destroyed, but because of their destruction the soil has been washed off the naked rock. The terrible consequence is that it is impossible now to undo the damage that has been done. Many centuries would have to pass before soil would again collect, or could be made to collect, in sufficient quantity once more to support the old-time forest growth. In consequence the Mongol Desert is practically extending eastward over northern China. The climate has changed and is still changing. It has changed even within the last half century, as the work of tree destruction has been consummated.

The great masses of arboreal vegetation on the mountains formerly absorbed the heat of the sun and sent up currents of cool air which brought the moisture-laden clouds lower and forced them to precipitate in rain a part of their burden of water. Now that there is no vegetation, the barren mountains, scorched by the sun, send up currents of heated air which drive away instead of attracting the rain clouds, and cause their moisture to be disseminated. In consequence, instead of the regular and plentiful rains which existed in these regions of China when the forests were still in evidence, the unfortunate inhabitants of the deforested lands now see their crops wither for lack of rainfall, while the seasons grow more and more irregular; and as the air becomes dryer certain crops refuse longer to grow at all.

That everything dries out faster than formerly is shown by the fact that the level of the wells all over the land has sunk perceptibly, many of them having become totally dry. In addition to the resulting agricultural distress, the watercourses have changed. Formerly they were narrow and deep, with an abundance of clear water the year around; for the roots and humus of the forests caught the rain-water and let it escape by slow, regular seepage. They have now become broad, shallow stream beds, in which muddy water trickles in slender currents during the dry seasons, while when it rains there are freshets, and

roaring muddy torrents come tearing down, bringing disaster and destruction everywhere.

Moreover, these floods and freshets, which diversify the general dryness, wash away from the mountain sides, and either wash away or cover in the valleys, the rich fertile soil which it took tens of thousands of years for nature to form; and it is lost forever, and until the forests grow again it can not be replaced. The sand and stones from the mountain sides are washed loose and come rolling down to cover the arable lands, and in consequence, throughout this part of China, many formerly rich districts are now sandy wastes, useless for human cultivation and even for pasture. The cities have been, of course, seriously affected, for the streams have gradually ceased to be navigable. There is testimony that even within the memory of men now living there has been a serious diminution of the rainfall in northeastern China. The level of the Sungari River, in northern Manchuria, has been sensibly lowered during the last fifty years, at least partly as the result of indiscriminate cutting of the forests forming its watershed. Almost all the rivers of northern China have become uncontrollable, and very dangerous to the dwellers along their banks, as a direct result of the destruction of the forests. The journey from Peking to Jehol shows in melancholy fashion how the soil has been washed away from whole valleys, so that they have been converted into deserts.

In northern China this disastrous process has gone on so long and has proceeded so far that no complete remedy could be applied. There are certain mountains in China from which the soil is gone so utterly that only the slow action of the ages could again restore it, although of course much could be done to prevent the still further eastward extension of the Mongolian Desert if the Chinese government would act at once. The accompanying cuts from photographs show the inconceivable desolation of the barren mountains in which certain of these rivers rise—mountains, be it remembered, which formerly supported dense forests of larches and firs, now unable to produce any wood, and because of their condition a source of danger to the whole country.

The photographs also show the same rivers after they have passed through the mountains, the beds having become broad and sandy because of the deforestation of the mountains. One of the photographs shows a caravan passing through a valley. Formerly, when the mountains were forested, it was thickly peopled by prosperous peasants. Now the floods have carried destruction all over the land and the valley is a stony desert. Another photograph shows a mountain road covered with the stones and rocks that are brought down in the rainy season from the mountains, which have already been deforested by human hands. Another shows a pebbly river bed in southern Manchuria, where what was once a great stream has dried up owing to the deforestation in the mountains. Only some scrubwood is left, which will disappear within a half century. Yet another shows the effect of one of the washouts, destroying an arable mountain side, these washouts being due to the removal of all vegetation; yet in this photograph the foreground shows that reforestation is still a possibility in places.

What has thus happened in northern China, what has happened in central Asia, in Palestine, in north Africa, in parts of the Mediterranean countries of Europe, will surely happen to our country if we do not exercise that wise forethought which should be one of the chief marks of any people calling itself civilized. Nothing should be permitted to stand in the way of

the preservation of the forests, and it is criminal to permit individuals to purchase a little gain for themselves through the destruction of forests when this destruction is fatal to the well-being of the whole country in the future.

Action should be begun forthwith, during the present session of the congress, for the improvement of our inland waterways —action which will result in giving us not only navigable but navigated rivers. We have spent hundreds of millions of dollars upon these waterways, yet the traffic on nearly all of them is steadily declining. This condition is the direct result of the absence of any comprehensive and far-seeing plan of waterway improvement. Obviously we can not continue thus to expend the revenues of the government without return. It is poor business to spend money for inland navigation unless we get it.

Inquiry into the condition of the Mississippi and its principal tributaries reveals very many instances of the utter waste caused by the methods which have hitherto obtained for the so-called "improvement" of navigation. A striking instance is supplied by the "improvement" of the Ohio, which, begun in 1824, was continued under a single plan for half a century. In 1875 a new plan was adopted and followed for a quarter of a century. In 1902 still a different plan was adopted and has since been pursued at a rate which only promises a navigable river in from twenty to one hundred years longer.

Such short-sighted, vacillating, and futile methods are accompanied by decreasing water-borne commerce and increasing traffic congestion on land, by increasing floods, and by the waste of public money. The remedy lies in abandoning the methods which have so signally failed and adopting new ones in keeping with the needs and demands of our people.

In a report on a measure introduced at the first session of the present congress, the secretary of war said: "The chief defect in the methods hitherto pursued lies in the absence of executive authority for originating comprehensive plans covering the country or natural divisions thereof." In this opinion I heartily concur. The present methods not only fail to give us inland navigation, but they are injurious to the army as well. What is virtually a permanent detail of the corps of engineers to civilian duty necessarily impairs the efficiency of our military establishment.

The military engineers have undoubtedly done efficient work in actual construction, but they are necessarily unsuited by their training and traditions to take the broad view, and to gather and transmit to the congress the commercial and industrial information and forecasts, upon which waterway improvement must always so largely rest. Furthermore, they have failed to grasp the great underlying fact that every stream is a unit from its source to its mouth, and that all its uses are interdependent.

Prominent officers of the engineer corps have recently even gone so far as to assert in print that waterways are not dependent upon the conservation of the forests about their headwaters. This position is opposed to all the recent work of the scientific bureaus of the government and to the general experience of mankind. A physician who disbelieved in vaccination would not be the right man to handle an epidemic of smallpox, nor should we leave a doctor sceptical about the transmission of yellow fever by the *Stegomyia* mosquito in charge of sanitation at Havana or Panama. So with the improvement of our rivers; it is no longer wise or safe to leave this great work in the hands of men who fail to grasp the essential relations between navigation and general development and to assimilate

and use the central facts about our streams.

Until the work of river improvement is undertaken in a modern way it can not have results that will meet the needs of this modern nation. These needs should be met without further dilly-dallying or delay. The plan which promises the best and quickest results is that of a permanent commission authorized to coordinate the work of all the government departments relating to waterways, and to frame and supervise the execution of a comprehensive plan. Under such a commission the actual work of construction might be intrusted to the reclamation service or to the military engineers, acting with a sufficient number of civilians to continue the work in time of war; or it might be divided between the reclamation service and the corps of engineers. Funds should be provided from current revenues, if it is deemed wise—otherwise from the sale of bonds. The essential thing is that the work should go forward under the best possible plan and with the least possible delay. We should have a new type of work and a new organization for planning and directing it. The time for playing with our waterways is past. The country demands results.

I urge that all our national parks adjacent to national forests be placed completely under the control of the forest service of the agricultural department, instead of leaving them as they now are, under the interior department and policed by the army. The congress should provide for superintendents, with adequate corps of first-class civilian scouts, or rangers, and, further, place the road construction under the superintendent instead of leaving it with the war department. Such a change in park management would result in economy and avoid the difficulties of administration which now arise from having the responsibility of care and protection divided between different departments. The need for this course is peculiarly great in the Yellowstone Park. This, like the Yosemite, is a great wonderland, and should be kept as a national playground. In both all wild things should be protected and the scenery kept wholly unmarred.

I am happy to say that I have been able to set aside in various parts of the country small, well-chosen tracts of ground to serve as sanctuaries and nurseries for wild creatures.

I had occasion in my message of May 4, 1906, to urge the passage of some law putting alcohol, used in the arts, industries, and manufactures, upon the free list; that is, to provide for the withdrawal free of tax of alcohol which is to be denatured for those purposes. The law of June 7, 1906, and its amendment of March 2, 1907, accomplished what was desired in that respect, and the use of denatured alcohol, as intended, is making a fair degree of progress and is entitled to further encouragement and support from the congress.

The pure-food legislation has already worked a benefit difficult to overestimate.

. . . . . .

The share that the national government should take in the broad work of education has not received the attention and the care it rightly deserves. The immediate responsibility for the support and improvement of our educational systems and institutions rests and should always rest with the people of the several states acting through their state and local governments, but the nation has an opportunity in educational work which must not be lost and a duty which should no longer be neglected.

The National Bureau of Education was established more than forty years ago. Its purpose is to collect and diffuse such information "as shall aid the people of the United States in the establishment and

maintenance of efficient school systems and otherwise promote the cause of education throughout the country." This purpose in no way conflicts with the educational work of the states, but may be made of great advantage to the states by giving them the fullest, most accurate, and hence the most helpful information and suggestion regarding the best educational systems. The nation, through its broader field of activities, its wider opportunity for obtaining information from all the states and from foreign countries, is able to do that which not even the richest states can do, and with the distinct additional advantage that the information thus obtained is used for the immediate benefit of all our people.

With the limited means hitherto provided the Bureau of Education has rendered efficient service, but the congress has neglected to adequately supply the bureau with means to meet the educational growth of the country. The appropriations for the general work of the bureau, outside education in Alaska, for the year 1909 are but $87,500—an amount less than they were ten years ago, and some of the important items in these appropriations are less than they were thirty years ago. It is an inexcusable waste of public money to appropriate an amount which is so inadequate as to make it impossible properly to do the work authorized, and it is unfair to the great educational interests of the country to deprive them of the value of the results which can be obtained by proper appropriations.

I earnestly recommend that this unfortunate state of affairs as regards the national education office be remedied by adequate appropriations. This recommendation is urged by the representatives of our common schools and great state universities and the leading educators, who all unite in requesting favorable consideration and action by the congress upon this subject.

I strongly urge that the request of the director of the census in connection with the decennial work so soon to be begun, be complied with, and that the appointments to the census force be placed under the civil-service law, waiving the geographical requirements as requested by the director of the census. The supervisors and enumerators should not be appointed under the civil-service law, for the reasons given by the director. I commend to the congress the careful consideration of the admirable report of the director of the census, and I trust that his recommendations will be adopted and immediate action thereon taken.

It is highly advisable that there should be intelligent action on the part of the nation on the question of preserving the health of the country. Through the practical extermination in San Francisco of disease-bearing rodents our country has thus far escaped the bubonic plague. This is but one of the many achievements of American health officers; and it shows what can be accomplished with a better organization than at present exists. The dangers to public health from food adulteration and from many other sources, such as the menace to the physical, mental and moral development of children from child labor, should be met and overcome. There are numerous diseases, which are now known to be preventable, which are, nevertheless, not prevented. The recent International Congress on Tuberculosis has made us painfully aware of the inadequacy of American public health legislation.

This nation can not afford to lag behind in the world-wide battle now being waged by all civilized people with the microscopic foes of mankind, nor ought we longer to ignore the reproach that this government takes more pains to protect the lives of

hogs and of cattle than of human beings. The first legislative step to be taken is that for the concentration of the proper bureaus into one of the existing departments. I therefore urgently recommend the passage of a bill which shall authorize a redistribution of the bureaus which shall best accomplish this end.

WOLCOTT GIBBS

DR. OLIVER WOLCOTT GIBBS, from 1863 to 1887 Rumford professor of applied science and later emeritus professor in Harvard University, past president of the National Academy of Sciences and of the American Association for the Advancement of Science, died at his home in Newport, R. I., on December 9, in his eighty-seventh year. We hope to print later an adequate appreciation of Professor Gibbs's contributions to chemistry. A biographical note, prepared by him about two years ago and given to his nephew, Dr. Alfred Tuckermann, with the request that it be published after his death, is as follows:

Oliver Wolcott Gibbs was born in New York, February 21, 1822. He was the second son of George and Laura Wolcott Gibbs and grandson of Oliver Wolcott, secretary of the treasury during part of the presidency of Washington and of John Adams. His father, Colonel George Gibbs, owned a large estate on Long Island known as Sunswick, a few miles from the then small city of New York. He was one of the earliest American mineralogists, devoted to that branch of science, and an active and successful horticulturist. Wolcott, like his elder brother, inherited his father's tastes: He was often occupied with making volcanoes with such materials as he could obtain and in searching the stone walls on the estate for minerals, and the gardens and fields for flowers. His mother was an artist of no mean ability, and often won the praises of Gilbert Stuart by her work. At the age of seven, Wolcott went to reside in Boston with his aunt, Miss Sarah Gibbs, who, at that time, with her brother-in-law, Dr. Channing, and her sister, occupied a fine mansion in Mount Vernon Street during the early spring and winter months. The boy was sent to a school kept by Mr. Leverett, a prominent Latin scholar. Among his fellow pupils were William M. Evarts, the two brothers Perkins, Greenough, Samuel Eliot and others who in time became distinguished. Miss Gibbs and the Channings spent the summers and autumns at Oakland, a large estate about five miles from Newport, Rhode Island, which, under their care, became, as it still is, very attractive. The summer home was a most hospitable one and Dr. Channing's fame brought many foreign visitors. When about twelve years of age, Wolcott, whose father had died in 1833 at Sunswick, was sent to a celebrated school at Flushing, Long Island, kept by the Rev. Dr. Muhlenberg. He was two years at this school of which he entertained always an affectionate remembrance. In 1835 the estate at Sunswick was sold and the family moved to New York. Wolcott was sent to the grammar school of Columbia College and in 1837 he entered Columbia College as a freshman.

In 1841 he graduated and later became assistant to Dr. Robert Hare who held the chair of chemistry in the medical school of the University of Pennsylvania. After some months in the laboratory, Wolcott commenced the study of medicine with the view of qualifying himself to hold the chair of chemistry in a medical school. After two years of study at the College of Physicians and Surgeons in New York, he received the degree of Doctor of Medicine in 1845, and shortly after sailed for Hamburg. He took up his residence in Berlin and entered, as a student, the laboratory of Professor Carl Rammelsberg. After some months with him, he entered the laboratory of Heinrich Rose, where he remained about a year. He then went to Giessen where he spent one semester with Liebig. Thence to Paris, where he attended lectures by Laurent and Dumas, and especially by Regnault. He returned to New York in the fall of 1848, having received from the College of Physicians and Surgeons an offer of an assistant professorship of chemistry, Dr. John Torrey being full professor. In 1849 he was elected professor of chemistry and

physics in the newly created Free Academy, now the College of the City of New York, and in 1853 married Josephine, daughter of Oroondates and Martha Eddy Mauran. He remained professor for fourteen years, when he was elected Rumford professor in Harvard University, to fill the vacancy occasioned by the resignation of Professor E. N. Horsford and removed to Cambridge in August, 1863. At the outbreak of the civil war, he took an active part in the creation of the Union League Club. In 1887 he resigned the Rumford professorship in Harvard University and built and equipped a laboratory near his residence at Newport, Rhode Island. Dr. Gibbs received the degree of LL.D. from Columbia College, Harvard University, the University of Pennsylvania and the Columbian University of Washington. He was an honorary member of the German, English and American Chemical Societies, of the Royal Society of Berlin and of the Philosophical Society of Philadelphia.

PRESIDENT ROOSEVELT'S AFRICAN TRIP

In March, 1909, Mr. Roosevelt will head a scientific expedition to Africa, outfitted by the Smithsonian Institution and starting from New York City. This expedition will gather natural history materials for the government collections, to be deposited by the Smithsonian Institution in the new United States National Museum, at Washington, D. C.

Besides the president and his son, Kermit Roosevelt, who will defray their own expenses, the personnel of the party, on leaving New York, will consist of three representatives of the Smithsonian Institution: Major Edgar A. Mearns, Medical Corps, U. S. Army (retired), Mr. Edmund Heller and Mr. J. Alden Loring. On arriving in Africa, the party will be enlarged by the addition of Mr. R. J. Cuninghame, who is now in Africa preparing the president's outfit. He will have charge of a number of native porters, who, with necessary animals, will be formed into a small caravan.

Mr. Roosevelt and his son will kill the big game, the skins and skeletons of which will be prepared and shipped to the United States by other members of the party. Mr. Kermit Roosevelt is to be the official photographer of the expedition.

The national collections are very deficient in natural history materials from the Dark Continent; and an effort will be made by the expedition to gather general collections in zoology and botany to supply some of its deficiencies; but the main effort will be to collect the large and vanishing African animals.

Mr. R. J. Cuninghame, who is now engaged in assembling the materials for Mr. Roosevelt's use, has been employed to act as guide and manager of the caravan. Mr. Cuninghame is also an experienced collector of natural history specimens, having made collections for the British Museum in Norway and Africa. He is an English field man, who has guided numerous hunting parties in Africa and who was chief hunter for the Field Columbian Exposition.

Mr. Edmund Heller, a graduate of Stanford University, class of 1901, is a thoroughly trained naturalist, whose special work will be the preparation and preservation of specimens of large animals. Mr. Heller is about thirty years of age. His former experience, when associated with Mr. D. G. Eliot and Mr. Ackley, of the Field Columbian Museum, in collecting big game animals in the same portions of Africa which Mr. Roosevelt will visit, will be a valuable asset to the expedition. Mr. Heller has had large experiences in animal collecting in Alaska, British Columbia, United States, Mexico, Central America and South America. In the year 1898 he made a collecting trip of eleven months to Gallapagos Islands, starting from San Francisco. He is the author of scientific papers on mammals, birds, reptiles and fishes. At present he is assistant curator of the Museum of Vertebrate Zoology of the University of California.

Mr. J. Alden Loring is a field naturalist, whose training comprises service in the Biological Survey of the Department of Agriculture, and in the Bronx Zoological Park, New York City, as well as on numerous collecting trips through British America, Mexico and the United States. He is about thirty-eight years

old. In August, September and October, 1898, he made the highest record for a traveling collector, having sent in to the United States National Museum 900 well-prepared specimens of small mammals in the three months' journey from London through Sweden, Germany, Switzerland and Belgium.

Major Edgar A. Mearns, a retired officer of the medical corps of the army, about fifty-three years of age, will be the physician of the trip and have charge of the Smithsonian portion of the party. He has had twenty-five years' experience as an army doctor, and is also well known as a naturalist and collector of natural history specimens.

The party will reach Mombasa in April, 1909. No detailed itinerary has been decided upon; but the general route will be up the Uganda Railway to Nairobi and Lake Victoria Nyanza, a distance of about 650 miles by rail, thence crossing into Uganda, and, finally, passing down the Nile to Cairo. Much of the hunting will be done in British East Africa, where the Uganda Railroad can be used as a base of supplies and means of ready transportation. At least one great mountain, possibly Mount Kenia, will be visited.

Khartum will be reached, if all goes well, about April, 1910. The expedition may be expected to spend about one year on African soil.

FRENCH VITAL STATISTICS

THE *Journal Officiel* has recently published the vital statistics of France for the year 1907, and these are summarized in the *British Medical Journal*. The excess of deaths over births during the year reached the unprecedented number of 19,920. There were 32,878 fewer births and 13,693 more deaths than in 1906. In 1907, 773,969 births were registered of infants alive at the time of the declaration; there were also 36,760 stillbirths or infants who died before the declaration of the birth—a total of 810,729 births. The proportion, calculated on the census of 1906, is 207 per 10,000 inhabitants; lower than 1906, when it was 215; in 1905 it was 216; in 1904 it was 219; in 1903 it was 221; in 1902 it was 226; in 1901 it was 230 per 10,000 inhabitants. This dimunition of the natality is general throughout the country, for in comparison with 1906 the number of living births fell in 82 departments, and only showed an increase in 5 departments. The following departments show the largest diminution in the absolute number of births: Dordogne, 1,434 fewer births; Finistère, 1,067; Côtes-de-Nord, 978; Ardèche, 972; Hérault, 928; Aveyron, 893; Isère, 773; Rhône, 732; Loire, 701. The departments which showed in 1907 the largest number of living birth per 10,000 inhabitants were: Finistère, 287; Pas-de-Calais, 285; Seine Inférieure, 258; Morbihan, 253; Côtes-du-Nord, 242; Nord, 239; Meurthe-et-Moselle, 238; Vosges, 230; Lozère, Territory of Belfort, 226; Doubs, 221. The smallest proportion was in the departments of Gers, 131; Lot-et-Garonne, 132; Yonne, 142; Lot, 143; Tarn-et-Garonne, 145; Haute-Garonne, 151; Nièvre, 155; Gironde, 156; all of which show a progressive decrease as compared with previous years.

During the year 1907 793,889 deaths were registered. This gives 13,693 more deaths than in 1906, and 10,510 more than the annual mean for the decennial period 1896–1905. The increase in the number of deaths as compared with 1906 includes 55 departments: Seine, 3,316 more than in 1906; Morbihan, 1,084; Manche, 1,070; Isère, 996; Gard, 721; Indre-et-Loire, 719; Nord, 695, etc. In 32 departments the number of deaths in 1907 was less than in 1906. Of these, the following show the largest decrease: Seine-Inférieure, 777; Pas-de-Calais, 619; Doubs, 579; Vosges, 558; Rhône, 498; Haute-Saône, 453; Somme, 294; Meuse, 291; Finistère, 682. The departments giving the largest number of deaths per 100,000 of the population are: Lot, 244; Tarn-et-Garonne, 240; Bouches-du-Rhône, 238; Manche, 237; Orne, 236; Ardèche, 234; Vaucluse, 233; Calvados, Gard, 232; Aveyron, 224. The following show the lowest mortality: Cher, 161 per 10,000 inhabitants; Creuse, 163; Indre, 165; Landes, 167; Allier, 169.

The relative increase in the population per 10,000 inhabitants reached the mean of 18 in 1901 to 1905; it fell to 7 in 1906, and in 1907 fell to *minus* 5 per 10,000.

In 1907 there was an excess of births in only 29 departments, as compared with 42 in 1906 and 43 in 1905, the departments showing this excess most markedly being: Pas-de-Calais, 103 per 10,000 inhabitants; Finistère, 89; Nord, 57; Morbihan, 51; Territorie de Belfort, 49; Haute-Vienne, 44; Seine-Inferièure, 37; Vosges, 36; Meurthe-et-Moselle, 35; Lozère, 34; Vendée, 33; Doubs, 26; Côtes du Nord and Corsica, 23. It will thus be seen that the regions which show an excess of births are the North, Britanny, the Eastern frontiers, Limousin, and Corsica, the departments inhabited by the Celtic, Flemish, and Basque races. In the basins of the Garonne and the Rhone each year the proportion of deaths over births increases, and thus Gascony and Provence are rapidly losing their characteristic population.

THE AMERICAN SOCIETY OF ANIMAL NUTRITION

In connection with the International Live Stock Exposition at Chicago, there was held on November 28, 1908, a meeting of those college and experiment station workers more especially interested in investigation in stock feeding. About thirty were present, representing experiment stations from Massachusetts to California and from Minnesota to Alabama. The meeting grew out of a conference of investigators in this subject, held at Cornell University last summer during the graduate summer school of agriculture, and resulted in the formation of The American Society of Animal Nutrition.

The objects of the society, as stated in the constitution which was adopted, are "To improve the quality of investigation in animal nutrition, to promote more systematic and better correlated study of feeding problems, and to facilitate personal intercourse between investigators in this field." In addition to holding an annual meeting, the society proposes to take up actively the consideration of methods of investigation and later to enter upon cooperative study of important problems of stock feeding. To this end, a standing committee on experiments and two special committees on methods were provided for and the committee appointed at the Cornell conference presented a full report outlining the work to be undertaken.

The officers of the new society are: *President,* H. P. Armsby, of Pennsylvania; *Vice-president,* C. F. Curtiss, of Iowa; *Secretary-treasurer,* D. H. Otis, of Wisconsin; *Registrar,* J. T. Willard, of Kansas. *Committee on Experiments:* H. J. Waters, of Missouri; H. W. Mumford, of Illinois; T. L. Haecker, of Minnesota; E. B. Forbes, of Ohio; W. H. Jordan, of New York.

SYMPOSIUM ON CORRELATION

SECTION E, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, AND GEOLOGICAL SOCIETY OF AMERICA

The program for a Symposium on the Principles and Criteria of Correlation is now completed, the following scientists having stated their readiness to discuss the several subjects opposite their names. The symposium will begin on Monday, December 28, under the auspices of Section E, and be carried as far as the time at the disposal of that section on Monday permits. On Tuesday and the following days, until completed, it will form a part of the program of the Geological Society of America, under a special subsection on correlation. The presentation and discussion of papers will be conducted strictly according to a definite time schedule, which will be stated in the program of the meeting.

C. R. Van Hise or C. K. Leith: "Principles of pre-Cambrian Correlation."

F. D. Adams: "The Basis of pre-Cambrian Correlation."

C. D. Walcott: "Evolution of Early Paleozoic Faunas in Relation to their Environment."

A. W. Grabau: "Physical and Faunal Evolution of North America in the Late Ordovicic, Siluric and Early Devonic Time."

Stuart Weller: "Correlation of Middle and Upper Devonian and Mississippian Faunas of North America."

G. H. Girty: "Physical and Faunal Changes of Pennsylvanian and Permian in North America."

David White: "The Upper Paleozoic Floras, their Succession and Range."

S. W. Williston: "Environmental Relations of the Early Vertebrates."

H. F. Osborn: "Environment and Relations of the Tertiary Mammalia."

T. W. Stanton: "Succession and Distribution of Later Mesozoic Invertebrate Faunas."

W. H. Dall: "Conditions governing the Evolution and Distribution of Tertiary Faunas."

Ralph Arnold: "Environment of the Tertiary Faunas of the Pacific Coast."

F. H. Knowlton: "Succession and Range of Mesozoic and Tertiary Floras."

R. D. Salisbury: "Physical Geography of the Pleistocene with Special Reference to Conditions Bearing on Correlation."

D. T. MacDougal: "Relation of Plants to Climate with Special Reference to Pleistocene Conditions."

T. C. Chamberlin: "Diastrophism as the Ultimate Basis of Correlation."

BAILEY WILLIS,
Vice-president of Section E
E. O. HOVEY,
Secretary of the Geological Society of America

THE AMERICAN SOCIETY OF NATURALISTS

THE following circular, prepared for members of the American Society of Naturalists, is published in SCIENCE, in the hope of reaching many members of the affiliated societies who are not now members of the Society of Naturalists. It is hoped that all who are interested in the scientific study of evolution will join the naturalists in making a systematic effort to present the results of modern investigation in this field. Many who have not hitherto attended to the matter will also now appreciate the other advantages to be accomplished by strengthening this association of the special scientific societies to which they belong. Candidates are requested to apply directly to the secretary of the society, in accordance with the article of the constitution printed below.

REORGANIZATION AND ANNUAL MEETING

In view of the opinion, apparently so wide spread, that the American Society of Naturalists has no important function, and is not meeting the requirements of a proper cooperation between its affiliated societies and others, the following plan of reorganization is presented by the president and executive committee. (Attention is especially called to paragraph 5.)

1. The Society of Naturalists shall remain independent of other general societies.

2. The Society shall continue to represent the natural affiliation between its group of technical societies composed of scientific specialists.

3. Cooperation with other organizations shall be accomplished through the executive committee, which shall be selected with a view to the establishment of such external relations.

4. The policy of the Society shall be redefined, so as to adjust it more definitely to exert an influence for the encouragement of research in the larger field of science which it has cultivated from the start.

5. It is suggested that the main object of the society be considered the study of evolution in all of its many-sided aspects (historical, environmental, experimental, etc.). There is no subject which would so well hold together all the present members (including botanists, zoologists, physiologists, anatomists, paleontologists, anthropologists, etc.). It is suggested, therefore, that each year original contributions dealing with evolutionary matters be presented at one or more of the sessions of the American Society of Naturalists. It may also prove desirable to have reports each year of the most important recent work in evolution, in several of its different aspects (botany, zoology, paleontology, etc.). In this way members could be kept in touch with the most important advances in different departments. Such reviews should be given by men eminent in their respective fields.

This year the Darwin Memorial Celebration of the American Association will be conducted along the lines sketched above. The Society of Naturalists will, therefore, not attempt, at this meeting, to present a similar program; but, after the presidential address, will devote its session to the consideration of other problems.

New Members

The above plan will doubtless attract a considerable number of investigators interested in the general problems of evolution, and it is hoped that all available candidates will be induced to join the Society at this time, and will have their names sent in.

ARTICLE II.—Section 1. Membership in this Society shall be limited to persons professionally engaged in some branch of Natural History, as, Instructors in Natural History, Officers of Mu-

seums and other Scientific Institutions, Physicians and others, who have essentially promoted the Natural History Sciences by original contributions of any kind. Any member may present to the Executive Committee of the Society or of the Branch to which he belongs names of candidates for membership, and those candidates who are approved by the Committee may be elected to membership in the Society by a majority of the members present at any meeting of the Branch.

Annual dues, $1.00.

This December Meeting—December 31, 1908

The next meeting of the American Society of Naturalists will be held in Baltimore, Md., at Johns Hopkins Medical School, in the auditorium of the Physiological Building, Thursday, December 31, 1908, at 3 P.M. The address of the President, Professor D. P. Penhallow, of McGill University, will be on "The Functions of the American Society of Naturalists." There will then be a brief discussion in which matters of much importance to the Society will be brought up. Speakers will be limited to ten minutes. Several prominent investigators have already agreed to take part. The annual business meeting will follow.

The coming meeting is important. It has become necessary to secure positive action from its members if the integrity of the society is to be maintained. Shall the Society be permitted to dissolve? No other association emphasizes so well the distinctively scientific interests of this group of special societies as does the Society of Naturalists. It should, therefore, be made more representative of those societies for which it stands. Its affiliated societies should always retain complete independence, and yet will be able to accomplish more for science by establishing more practical machinery for cooperation. The Naturalists will then be able to act together effectively in dealing with general problems or with other more general societies.

The usual annual dinner will this year be merged with the Darwin dinner of the American Association for the Advancement of Science, to be held on the evening of January 1, 1909. This Society has also been invited to attend the Darwin Memorial Exercises on January 1, organized under the auspices of the American Association.

Members are requested to send their correct addresses, etc., to the secretary at once, so that an accurate membership list may be printed.

For particulars of the arrangements of rates, hotels, etc., for the Baltimore meeting consult the Announcement of the American Association, or Dr. L. O. Howard, Smithsonian Institution, Washington, D. C.

By order of the Executive Committee:

D. P. Penhallow, *President.*
T. H. Morgan, *Vice-President and Chairman of the Eastern Branch.*
R. A. Harper, *Vice-President and Chairman of the Central Branch.*
Thos. G. Lee, *Secretary of Central Branch.*
H. von Schrenk, *Treasurer.*
O. W. Caldwell, W. R. Coe, } *Members of Executive Committee.*
H. McE. Knower, *Secretary,*
Johns Hopkins Medical School,
Baltimore, Md.

December 1, 1908

SCIENTIFIC NOTES AND NEWS

According to a cablegram to the daily papers from Stockholm, King Gustaf distributed the Nobel prizes on December 10. The awards, not identical in the cases of physics and literature with those cabled to this country last week, are as follows: Literature, Dr. Rudolf Eucken, professor of philosophy at Jena; physics, Professor Gabriel Lippman, of the University of Paris; chemistry, Professor Ernest Rutherford, director of the physical laboratory of the University of Manchester, England; medicine, divided between Dr. Paul Ehrlich, of Berlin, and Professor Elie Metchnikoff, of the Pasteur Institute, Paris; the promotion of peace, K. P. Arnoldson, of Sweden, and M. F. Bajer, of Denmark.

The Paris Academy of Sciences has divided the LaLande prize between Professor W. L. Elkin, director of the Yale Observatory, and Dr. F. L. Chase, assistant astronomer in the observatory, for their papers on "The Parallaxes of 163 Stars." Mr. M. F. Smith, assistant in the observatory, was given honorable mention in the award.

Professor George Davidson, head of the geographical department of the University of California, has been presented with the Charles P. Daly medal of the American Geographical Society.

Dr. John G. Curtis, professor of physiology in the College of Physicians and Surgeons of

Columbia University since 1875, and Dr. T. Mitchell Prudden, professor of pathology since 1891, will retire on June 30, next.

DR. E. BENJAMIN ANDREWS has been compelled by failing health to resign the chancellorship of the University of Nebraska, and will retire from the office December 31, 1908. On December 8 a special convocation was held of students and faculties in honor of the retiring chancellor, at which somewhat extended addresses were made by Honorable William G. Whitmore of the board of regents, Judge E. P. Holmes of the alumni, and Professor C. E. Bessey of the university faculties. On the evening of the same day, the Faculty Dinner Club gave a complimentary banquet at which distinguished men from all parts of the state were present to do him honor. Many short addresses were made by representatives of the professors, regents, alumni and citizens of the state, as well as by the governor and the governor-elect. The banquet was closed by a farewell address by Dr. Andrews.

IN addition to the program of addresses to be given at the Darwin celebration already published in SCIENCE on October 30, page 602, certain brief addresses have been arranged for at the time of the dinner as follows: Professor W. H. Welch, "On the Debt of Medicine to Darwinism"; Professor Edward Poulton, and Professor Albrecht Penck, "On the Geographical Factor in Evolution." The details of the dinner arrangements will be published at the time of the meeting. The dinner will be a memorable occasion and all will wish to attend. In order that proper accommodations may be supplied, it will be necessary to obtain tickets for the dinner as early as possible during convocation week.

MR. CHARLES H. TOWNSEND, director of the New York Aquarium, has been made a life member of the American Museum of Natural History, in recognition of his gift of mounted specimens of birds from Alaska and ethnological material from the South Sea Islands.

DR. BASHFORD DEAN, professor of vertebrate zoology in Columbia University, has been elected an honorary fellow because of gratuitous services during the past five years to the department of vertebrate paleontology, especially in respect to the collection of fossil fishes.

THE Rev. Thomas Roscoe Reid Stebbing, M.A., F.R.S., F.L.S., gold medalist of the Linnean Society, formerly fellow and tutor of Worcester College, Oxford, has been elected an honorary fellow of the college.

PRESIDENT CHARLES F. COX has been appointed the delegate of the New York Academy of Sciences to the Darwin centennial anniversary exercises at the University of Cambridge.

PROFESSOR EDWARD E. PRINCE, fish commissioner of Canada, has been appointed, in place of Mr. Samuel T. Bastedo, resigned, the British representative on the International Fisheries Commission having in charge the preparation of joint statutes to govern the fisheries of the international boundary waters. President David Starr Jordan is the American Commissioner.

AN investigation into the cause of cancer and its possible prevention and cure has been begun in the College of Physicians and Surgeons, Columbia University, under the direction of a committee consisting of Dr. Samuel W. Lambert, dean; Dr. William J. Gies, professor of biological chemistry; Dr. Philip Hanson Hiss, Jr., professor of bacteriology; Dr. Francis Carter Wood, professor of clinical pathology; Dr. Gary N. Calkins, professor of protozoology, and Dr. Eugene H. Pool, instructor in the department of surgery.

THE field parties of the U. S. Biological Survey have now returned to Washington for the winter. The biological survey of New Mexico under Vernon Bailey, assisted by E. A. Goldman and Clarence Birdseye, is nearly completed. Field work in southern Utah, discontinued several years ago, has been resumed under W. H. Osgood. Field work in Colorado, under Merritt Cary, has been finished, and the report is now nearly ready for publication. In the southern states work on geographic distribution has been continued by A. H. Howell in Alabama, Georgia, Kentucky, Louisiana, Mississippi, Tennessee and Virginia.

Offprints of articles on genetics for notice in the *Zeitschrift für induktive Abstammungs- und Vererbungslehre* should be sent to Dr. E. M. East, Agricultural Experiment Station, New Haven, Conn.

President-designate Taft will deliver the oration at the University of Pennsylvania at the annual celebration on Washington's birthday.

Dr. Francis G. Benedict, director of the Nutrition Laboratory of the Carnegie Institution at Boston, will give the first of a series of special lectures on hygiene to the students of the University of Wisconsin. Dr. Benedict will speak on "The Influence of Mental and Muscular Work on the Assimilation of Food."

The regular meeting of the Columbia Chapter of the Society of Sigma Xi was held on December 10, when Professor William H. Burr, of the department of civil engineering, addressed the society on the topic "The Quebec and Blackwells Island Cantilever Bridges." The lecturer discussed the cause of the failure of the former and the recent criticisms of the latter and the reports of the investigations of that structure recently made public.

At the first meeting of the Cornell Chapter of Sigma Xi for the present year, held on November 21, President Edmund A. Engler, of the Worcester Polytechnic Institute, gave an address on "The Reign of Law." About forty members of the chapter were present.

Dr. J. Paul Goode, of the University of Chicago, gave an address before the Geographical Society of Chicago, on December 11, on the subject "The Great Seaports of Europe."

Professor S. A. Mitchell, of Columbia University, has been delivering courses of lectures on astronomy at Asbury Park, N. J., Totterville, N. Y., and Newark, N. J.

The Vienna College of Physicians will celebrate the centenary of the death of Auenbrugger, the inventor of percussion, on May 18, 1909. A marble memorial tablet will be placed on the house in which he died.

A medallion of M. Laveran has been placed in the military hospital of Constantine, Algiers, where he discovered the parasite of malaria in 1880.

Mrs. Frederick F. Thompson has given to the New York State Museum as a memorial of her father, former Governor Myron H. Clark, the sum of fifteen thousand dollars, for a representation of the culture of the Six Nations of New York, to be known as the Clark Museum of Iroquois Culture.

A press despatch from Washington, dated December 8, says: "Appropriations aggregating $636,300 were made to-day at the annual meeting of the board of trustees of the Carnegie Institution of Washington. This amount is not intended to cover any new work, but will cover the operations of the institution planned for 1909. Dr. Carroll D. Wright, president of Clark College, presented his resignation as trustee, but indicated a desire to continue his work as director of the department of economics and sociology of the institution. Dr. Charles W. Eliot, president of Harvard University, and Mr. Martin A. Ryerson, of Chicago, were elected trustees of the institution to fill vacancies in the board."

The graduate clubs of the departments of philosophy, history, political economy, political science and sociology of the University of Chicago have formed an interdepartmental organization known as the Social Science Clubs Union with Mr. L. L. Bernard, of the department of sociology, as president. The union plans to have during the year a number of meetings and four lectures, by distinguished men from outside the university, on topics of interest to all the departments. The meeting of December 17 will be addressed by Professor Roscoe Pound, of Northwestern University Law School, on "Freedom of Contract—the notion of an inviolable right of contracting as one pleases which is one of the chief legal obstacles in the way of modern social legislation." The union has the financial backing of the university.

Portraits, given by various persons, of the following distinguished men have been framed and hung in the seminary room of the social sciences and history in Linsly Hall, Yale University: Christopher Columbus, William Pat-

terson, Adam Smith, John Law, Arthur Young, the Earl of Shaftesbury, Herbert Spencer, Jean Jacques Rousseau, Jeremy Bentham, P. J. Proudhon, Charles Fourier, Sir William Petty, Robert Owen.

THE necessary appropriation having been made by the trustees of the Carnegie Institution of Washington, on December 8, 1908, the contract for the construction of the magnetic survey yacht *Carnegie* was awarded on December 9, as the result of competition, to the Tobe Yacht Basin Company, of Brooklyn, N. Y. The vice-president and manager of this firm, Mr. Wallace Downey, has had charge of the building of several well-known yachts, *e. g.,* the *Meteor* (Kaiser Wilhelm's yacht) and the *Atlantic,* which won the Atlantic cup race of 1906. The vessel is to be completed by July 1, 1909. Mr. Henry J. Gielow, of New York City, is the naval architect and engineer-in-charge; he will be assisted in the work of inspection by Mr. W. J. Peters, formerly in command of the *Galilee* and to have charge of the *Carnegie.* The general dimensions of the *Carnegie* will be: length over all, 155½ feet; length on load water line, 128½ feet; beam molded, 33 feet; draught, 12 feet 7 inches.

ACCORDING to despatches to the London papers from New Zealand, the *Nimrod* sailed on December 1 from Lyttelton for King Edward VII. Land, to take on board Lieutenant E. H. Shackleton, R.N.R., and his party of explorers, who, for the best part of the year, have been engaged in an attempt to reach the South Pole. The *Nimrod* left England in August, 1907, and arrived at New Zealand on November 23, 1907. After embarking Lieutenant Shackleton and the other scientific men and explorers, the *Nimrod* left Lyttelton on January 1, 1908, and made her way southward to the ice-pack. The explorers landed and the *Nimrod* came back to Lyttelton. Since then she has undergone a thorough overhaul, and the scientists' quarters on deck have been enlarged to nearly twice their original size, so that in the event of any of the shore party being ill they would have some place to use as a hospital. It is anticipated that six weeks will be taken in the passage from Lyttelton to the landing place in the far south. Lieutenant Shackleton and his party will, it is hoped, put in an appearance before the end of February, after which the *Nimrod* would make her way back to Lyttelton. It appears improbable that the ship will have to winter in the Antarctic. The vessel takes with her from Lyttelton to the Antarctic 280 tons of coal, and stores sufficient to last thirty-eight men for one year. She is now commanded by Lieutenant F. P. Evans, R.N.R., who was master of the steamer which towed the *Nimrod* from Lyttelton to the ice-pack at the beginning of the present year.

THE third series of Norman W. Harris lectures at Northwestern University, given by Dr. Henry Fairfield Osborn, from December 3 to 8 on "The Age of the Mammals of Europe and America," was as follows:

Lecture I. Rise and Progress of Paleontological Discovery in Europe and America. Relations of Exploration, Research and Theory of Interpretation. Leaders in American Discoveries and Paleontological Methods.

Lecture II. General Comparison of the Physiography of America and Europe during the Age of Mammals and the Close of the Reptilian Age. Principals of Paleogeography. Sources of the World Stock of Mammals and of Successive Migrations.

Lecture III. Decline of the Archaic or Mesozoic Mammals, and Rise of the Modernized Mammals in America and Europe during the Eocene and Oligocene Periods. The Common and Independent Evolution on the Two Continents. Principles of Adaptive Radiation or Divergence.

Lecture IV. The Middle or Miocene Period. Invasion and Prevalence of African Types and Conditions of Life.

Lecture V. The Pliocene Period, Invasion and Intermingling of South American Forms. Contrasts and Resemblances between American and European Conditions.

Lecture VI. The Early and Mid-Pleistocene Periods. Extinction of the Large American Native Animals, and Repopulation from Europe and Asia. Causes of Extinction. Conclusions as to the Nature and Causes of Evolution of the Mammals.

A CORRESPONDENT of the *Transcript* writes that simplified phonetic spelling is to be introduced in the public schools of France by

M. Dougmergue, the minister of public instruction. This reform received the approval of the French Academy as long ago as 1893, but has not heretofore received government sanction. It provides for the suppression of the "h" in the Greek group of words like "rhetorique," "rhinoceros," etc., the substitution of "i" for "y" in "analyse," "style," etc., the substitution of "c" for the sibilant "t" in words like "confidential," etc., and the extension of the "s" as a sign of the plural in words ending in "ou," "eau" and "au." It also provides for the suppression of the "h" in words like "theatre," the substitution of "f" for "ph" in words like "phenomene" and the elimination of the double "n" in words like "paysanne."

Since 1890 there has existed in Paris a little museum of hygiene, containing among other things, the exhibits which figured in the Paris pavilion of hygiene at the exposition of 1900, and which have to do especially with the sanitation of dwellings, the emptying of latrines and sewers, etc. According to the *Journal* of the American Medical Association there is now a plan to complete and to install the collections so as to make of them a real model museum of hygiene and sanitation. It will comprise the twelve following sections: Air and light (composition, meteorology; lighting of the city; lighting, heating and ventilation of the house); water (composition and bacteriology; flowing waters of rivers and springs, ozonation; distribution, filters, private baths, etc.); food and clothing (composition of foods, nutritive value, adulteration, sterilization of milk; hygiene of clothing, impermeability, etc.); preventive hygiene (disinfection, measures against fire, materials of construction); hygiene of infancy (feeding of infants, gymnastics); establishments such as hospitals, asylums, soup-kitchens; hygiene of special establishments (arrangement, heating, etc., of barracks, prisons, schools, cheap houses); residues of life (cemeteries and cremation; household refuse; rain-water and slops, night soil; sewers; emptying of used waters); public conveyances (omnibuses and fiacres; neatness, ventilation, disinfection, cleaning, etc.); smoke; demography; library.

UNIVERSITY AND EDUCATIONAL NEWS

We regret to learn that the will of Frederick Cooper Hewitt, which made large bequests for public purposes, including $500,000 to Yale University, is being contested by a sister.

Governor John J. Johnson, of Minnesota, went to Washington on December 12, to invite President Roosevelt on behalf of the regents to accept the presidency of the University of Minnesota, but he declined this invitation.

Dr. Samuel Avery, head professor of chemistry in the University of Nebraska, was elected acting chancellor at a recent meeting of the regents, on account of the resignation of Chancellor Andrews. Dr. Avery will assume the duties of the office on January 1.

Hon. Timothy Hopkins, of Menlo Park, California, well known as a patron of zoological research, and for whom the nudibranch genus of *Hopkinsia* has been named, has been elected president of the board of trustees of Stanford University.

Dr. Hochstetter, professor of anatomy at Innsbruck, has been appointed to the chair of anatomy in the University of Vienna.

DISCUSSION AND CORRESPONDENCE

THE FIVE HUNDREDTH ANNIVERSARY OF THE UNIVERSITY OF LEIPZIG

During August, 1909, the University of Leipzig is to celebrate its Five Hundredth Anniversary. It would be eminently fitting for the Americans who have taken their doctor's degrees at Leipzig to send to the university on that occasion some formal address of congratulation. A list of about one hundred Americans who have taken their degrees at Leipzig has been prepared, including all of the names of American scientists mentioned in "American Men of Science" and such others as could be secured from a few former Leipzig students in the vicinity of New York and New Haven.

A small committee has organized itself in

an informal way for the purpose of collecting suggestions and information. If the movement seems to be of interest to those who are reached by this letter, a more formal organization can be perfected later and the congratulatory message can be issued by a representative committee.

The undersigned, acting as secretary for the preliminary informal committee, begs leave to request (1) suggestions with regard to the mode of procedure which would be most effective in presenting to Leipzig University the expression of congratulation from former American students; (2) information with regard to Americans in all departments who have received their degrees at Leipzig. The present list is complete for all names included in "American Men of Science"; it is otherwise very fragmentary and should be supplemented even at the risk of duplicating names from various sources.

It is requested that replies be sent at the earliest possible moment in order that the organization may be completed before January.

For the Committee,

CHARLES H. JUDD

YALE UNIVERSITY,
NEW HAVEN, CONN.,
December 2, 1908

MALARIA IN THE WEST INDIES

TO THE EDITOR OF SCIENCE: In SCIENCE for August 28, 1908, p. 273, a note taken from the London *Times* appears in which it is stated that "Malaria is very much less common in Barbados than in other West Indian islands" and that the small fish known as "millions" (*Girardinus pœciloides*) "destroys large numbers of the larvæ of mosquitos that spread malaria."

These are the usual newspaper statements regarding the habits of these very interesting little fish, and they have frequently appeared recently in different papers. They are, however, not quite correct, in that the malaria-bearing mosquito (*Anopheles*) does not occur in Barbados and it is generally believed that no case of malaria has ever originated in this island.

"Millions" eat the larvæ of mosquitos and many forms of aquatic animal life. The permanent pools and small streams which would be the natural breeding places of the *Anopheles* mosquito are inhabited by "millions." Other mosquitos are able to maintain themselves in Barbados because they naturally breed in water which is not inhabited by "millions," but there is a possibility that the absence of *Anopheles* in this island may be due, wholly or in part to the presence of enormous numbers of these small fish.

The Imperial Department of Agriculture has introduced "millions" into Antigua, St. Kitts-Nevis and Jamaica and they have been taken to British Guiana and Colon. "Millions" are among the most active natural enemies of mosquitos and in any malarial country where they become established they will be almost certain to exert a very considerable effect on the prevalence of the malarial mosquitos, because they naturally inhabit the breeding places of *Anopheles*. In any locality where it is possible to establish "millions" in rain-water tanks, reservoirs, fountains, etc., much relief may be had from the mosquito nuisance.

The "millions" of Barbados are closely related to the top-minnows found in different parts of the United States, certain species of which are well known as natural enemies of mosquitos. Top-minnows from Texas have been introduced into the Hawaiian Islands, and similar fish have frequently been used in stocking streams and ponds for the purpose of reducing the numbers of mosquitos in certain localities.

H. A. BALLON

IMPERIAL DEPARTMENT OF AGRICULTURE
FOR THE WEST INDIES

THE ODONATA OF MEXICO

TO THE EDITOR OF SCIENCE: In my article on "The Present State of our Knowledge of the Odonata of Mexico and Central America," published in SCIENCE for November 13, 1908, I have unintentionally omitted the Ohio State University from the list of cooperating in-

stitutions on page 692. Regretting the oversight, this note is offered in correction.

PHILIP P. CALVERT

QUOTATIONS

CLERICAL HEALING

THE announcement made a few weeks ago by the rector of an Episcopal church in this city, that he was going to take up the practise of medicine as a part of his clerical work, calls renewed attention to this curious movement. While it was confined to the Emmanuel Church people in Boston it was generally regarded as a sort of Neo-Eddyism, one more of the many queer fads with which the citizens of that town are wont to amuse themselves, and little more was thought of it. Now, however, two at least of the Episcopal churches in New York are going to adopt the Emmanuel plan of treating disease, and doubtless some of the rectors of other churches in that denomination will be ready to join the ranks of irregular practitioners. It is time therefore to ask what the movement means, and why physicians, even trained neurologists, are to be found lending themselves to the movement and supporting it by voice and pen.

The first question raised by a perusal of the official book of the Emmanuel movement, is, why? Why clerical healing, and why the limitation of clerical healing to functional diseases? We do not find either question answered satisfactorily in this book and we do not see how they can be answered. If the physician is to entrust the care of his patients to the clergymen why not to the lawyer? The latter is as much the confidant of his clients as the minister of his parishioners, and could speak just as authoritatively to the subliminal self of the sick. But the physician ought to be able to speak with much greater effect. When he can not, the explanation must be found in that curious state of mind which leads the ignorant to trust the confident amateur rather than the professional, to pin greater faith to quack remedies or grandmother's simples than to the prescription of the physician. The skilful physician despises no remedy which may benefit his patient, and if he believes a word from a sincere and tactful minister of the gospel will help, he is glad to send, and often does send, the sick man to the clergyman. As physicians we should regret indeed to lose the powerful therapeutic force that resides in religion, but it does not follow from this that we are ready to welcome the priest as a fellow practitioner of medicine, or even to acknowledge that he can exercise that function in the public and wholesale way of the Emmanuel rectors without the danger of doing far more harm than good.—*Medical Record.*

SCIENTIFIC BOOKS

Traité de Géologie: I. Les Phénomènes géologiques. By Mons. EMILE HAUG, Professeur a la Faculté des Sciences de l'Université de Paris. Pp. 536. Libraire Armand Colin, 5 rue de Mézières, Paris, France. 1907. Price, 12 fr. 50.

Though primarily intended for the use of French students, Mons. Haug's excellent volume, recently published, is worthy of study by American geologists. A text-book or treatise dealing with the whole subject of geology should be a sort of clearing-house wherein is struck the true balance of competing ideas, suggestions and hypotheses, so far as that is possible in the progressive science. Only the first part of this newest treatise, that relating to the geological processes, has been issued, but it is fair to suppose that the author's conception of the principles of geology is rather fully presented. At the very first one is struck with the compactness of thought and expression throughout the work; Mons. Haug is to be congratulated on his success in preserving a very readable style while packing into his chapters a truly remarkable amount of fundamental material. The author has not followed the beaten track and the pages are full of valuable new thoughts.

The work is unusual in its order of treatment. The complex is considered before the relatively simple; geosynclinals, metamorphism, orogeny, epeirogeny and igneous intrusion are discussed before underground water, weathering, and river, glacial and

marine erosion. It is not clear why chapter 28 on displacements of the shore-line is so far removed from chapter 16 on the vertical movements of the earth's crust.

As was to be expected, the author lays principal stress on the conception of the geosyncline. For the first time a European textbook states this idea at length sufficient to impress the student with its great importance. The statement is, however, charged with details which must lead to debate. For example, the diagram of a typical geosyncline in cross-section (p. 159) indicates a more or less perfect symmetry in the lithological composition of the sedimentary prism filling the down-warp. Yet is not the world's average geosynclinal prism lithologically unsymmetric in cross-section? The reviewer believes that the rule is to find the sediments on one side of a geosynclinal prism relatively coarse-grained because near the main region of erosion, the sediments growing finer-grained toward the opposite side of the prism. The idea of symmetry is probably suggested by Mons. Haug as a by-product of his hypothesis concerning the location of geosynclinal down-warps. He writes (p. 166): "loin de prendre naissance sur le bord des océans, les géosynclinaux sont toujours situés entre deux masses continentales et constituent des zones essentiellement mobiles, comprises entre deux masses relativement stables." Can this be correct? Is it safe to generalize from the geosynclinals[1] situated in the subequatorial zone of down-warps, Mediterranean seas and mountain-ranges? It is clear that the Alps and the Himalaya appear to follow the law as stated; but for most of the other "Mesozoic" geosynclinals the author has allowed his fancy to run very far. On page 162 a world-map is inserted, showing a wholesale "restoration" of the earth in Mesozoic times and a zone of Mesozoic geosynclines almost completely surrounding the area of the present Pacific Ocean. To make this ancestor of the mountain-built "circle of fire" obey the law, Mons. Haug hypothecates a Mesozoic Pacific continent some 75,000,000 square miles in area. He similarly "restores" a "continent nordatlantique," a "continent Sino-Sibérien," a "continent Africano-Brésilien," and a "continent Australe-Indo-Malgache." The obvious objection to this vast restoration of land-areas over the sites of the present ocean-basins is most inadequately discussed. In fact, almost the only words bearing on the fundamental matter are the following:

> On a cependant objecté aux conclusions qui viennent d'être exposées, la difficulté de loger toute l'eau des mers qui remplit actuellement de profondes dépressions auxquelles nous attribuons une origine récente. On oublie que les continents étaient beaucoup moins étendues qu'aujourd'hui et que des fosses profondes occupaient des emplacements où se dressent maintenant de hautes chaines de montagnes. L'océan Arctique semble avoir toujours existé et il a pu avoir une profondeur bieu superieure à sa profondeur actuelle. De plus, nous ne savons pas si entre Madagascar, l'Australie et le continent Antarctique ne se trouvait pas également une très profonde dépression (pp. 532–3).

But the simplest computation shows that these Arctic and South Indian oceanic basins, together with all the possible volume of the seas of transgression in the Mesozoic, are utterly incompetent to receive the 150,000,000 cubic miles of water which must be displaced to make room for the "restored" continents. It may be added that the facts of plant and animal distribution in no wise necessitate such drastic "restoration" of land-areas for the Mesozoic.

The chapters devoted to petrographic geology can hardly be regarded as satisfactory. Much emphasis is placed on the theoretical views of a few French authors, but the constructive work of men like Loewinson-Lessing, Vogt, Teall and Doelter is not discussed and, in general, not even mentioned. The view that granite is the final term of the metamorphism of geosynclinal sediments is presented, but no mention is made of the enormous physical and geological difficulties confronting this seductive hypothesis. The heat of fusion is attributed to the "rise of the

[1] The reviewer here uses this word to mean the sedimentary prism formed in the down-warp or "geosyncline."

isogeotherms" (with normal temperature gradient) into the lower beds of a sinking geosynclinal prism—a demonstrably inadequate source of the required heat. On page 174 we have:

> Le granite est formé des mêmes éléments caractéristiques que le gneiss. Plusieurs auteurs l'envisagaient, probablement avec raison, comme le terme ultime du métamorphisme, et il convient peut-être d'attribuer la même origine aux roches granitoïdes basiques, à la syenite, à la diorite, au gabbro, etc. (!)

In the table of geological periods we find the traditional but inaccurate names "ère Primaire" and "ère Secondaire" used as synonyms for "ère Paléozoïque" and "ère Mésozoïque." The "période Algonkienne" enters the table; it will be interesting to see, in the second volume, what definition a French author can give this expression. For the North American geologist "Algonkian" is hard enough to define; "Algonkian period" is harder to define.

In form of publication the book marks a distinct advance over its only rival in the French language—A. de Lapparent's "Traité de Géologie." The improvement is notable in the style of the letter-press and in the introduction of many attractive illustrations. The book is marred by the lack of an index—a lack which can not be made up by the insertion of a general index in a succeeding volume, for the present thick one should be bound alone. The "Table des Matières" is placed at the end of the volume, where the index would also be placed if it had been printed. One may hope that some day the French will change their tradition and place the table of contents in the front of the book. Who of us has not wasted precious time searching out the "Table des Matières" among the appendixes, plates and index sheets of French texts!

Reginald A. Daly
Massachusetts Institute of Technology

A Text-Book on Sound. By Edwin H. Barton, Professor of Experimental Physics, University College, Nottingham. London, Macmillan and Co., Limited. 1908.

There was need of a treatise on sound, which would neither be taken up wholly with a mathematical discussion of dynamical principles, nor consist merely of experiments, and yet which would so combine these features and so fully cover the subject as to deserve the attention and meet the needs of the serious student of acoustics. Barton's "Text-Book of Sound" occupies such a place.

It is forty-five years since Helmholtz's classic, "Tonempfindungen," appeared, and thirty-one since the publication of Lord Rayleigh's masterly treatise, and in that time no work worthy to rank with these has been produced. The first volume of such a treatise by the late Professor Donkin was published in 1870, and this was of the same order as the two works mentioned, but it is doubtful whether it could have appealed to a large number of readers or to any but most accomplished mathematicians if it had been completed on the lines upon which the initial volume proceeded.

In the past forty years admirable treatises on heat have appeared, keeping pace with the development of the subject, still more on light; while those on electricity have been numerous enough and varied enough to satisfy almost every want; but sound as a branch of physics seems to have been side-tracked. Of course, the subject has been included in all compendiums or treatises on general physics, and to these the author acknowledges his indebtedness.

Barton's "Text-Book of Sound" is admirable on many accounts and has little to object to. Indeed all the material in it is excellent, the principal question in regard to some of it being one as to its relevancy. Unless one admits the propriety of including all wave phenomena in the theory of sound it would seem as if some things here were superfluous. Following approved precedents in defining "Acoustics, or the study of sound, as that branch of physics which deals with vibratory motion as perceived by the sense of hearing," an adherence to this definition might save the author from the necessity of discussing all the causes and peculiarities of wave motion. Pos-

sibly, a full presentation of simple harmonic motion might be appropriate, since all waves, transverse or longitudinal, which result in sound are of that form of motion, but it could hardly be necessary to go into any considerable discussion of elasticity or the determination of elastic constants. It should be sufficient, it would seem, to point out that in accordance with Hooke's law all vibrations due to elasticity are simple harmonic motions. In America, at least, a student capable of reading a work like this intelligently would very probably be so far familiar with the principles of elasticity as to make chapter III. superfluous, and the like would be true regarding some other portions that are not obviously of an acoustic nature. Even if their connection with acoustics is ultimately fundamental, it is so remote as to suggest comparison with the works of a watch which have nothing to do with the case. Their presence, however, is not a serious fault if it secures better treatment of other parts that could not be omitted. It is a question whether simple harmonic motion in connection with sound is not overdone. It is true that elastic vibrations are simple harmonic motions, but so far as sound is concerned its reception by or transmission to the ear is always due to longitudinal vibration, and the intricate composition of transverse vibrations helps very little in interpreting the superposition or interference of longitudinal waves in the medium through which the sound is transmitted. Still, the phonograph and the telephone have of necessity forced the study of acoustics along the line of vibrating plates. It is interesting to note how the very delicate points in acoustics are best appreciated by seeing instead of hearing.

The last chapter, devoted to recorders and reproducers, is most interesting and important, although some of it goes pretty far afield for sound. A good instance is given of rhythm resulting from sound vibrations and, without being itself sound, transmitted electrically as rhythm and perceived by dipping fingers into a conducting liquid. This may illustrate the vibrations of a plate as a source of sound, but they are neither transmitted nor perceived as sound at all, there being no evidence of any material vibration in the transmitting media or in the organ of perception. Of course this is very different from telephonic reproduction, where there is distinctly a sounding disk at the receiving as well as at the sending terminal. This chapter serves to show how greatly the domain of acoustics has widened since the earlier work of Donkin and Helmholtz, and it also points out how the theory of sound is connected with that of electricity through wave motion. The value of the chapter is heightened by the original work of the author upon electric oscillations.

We notice the introduction of the term sound-rays. Although this is unusual, the use of the term ray to designate a normal to a wave front is becoming so common in text-books as to justify it in connection with sound, even though the conception of a material ray of sound has never had any favor.

In enumerating several forms of sensitive flames the Govi-Barry flame, which is so easy to produce and so wide in its range of sensibility might well have been included.

A few errors have escaped the proof-reader, but probably not more than are to be expected in a first edition. Such are the omission of an exponent after equation (1) on page 225, and an uncompleted sentence at the top of page 371. But when the few points have been mentioned to which exception might be taken, there remain so many more to be commended that the balance is greatly in favor of the work. The admirable choice and distribution of experiments, the masterly character of the discussions, the ample scope of the work and its attractive typography and make-up, constitute it a welcome addition to the text-books of this division of physics.

D. W. HERING

The Nature and Development of Plants, by CARLTON C. CURTIS, instructor in botany in Columbia University. Henry Holt & Company, publishers.

THOUGH published last year, the book has not yet received, in the way of review, the notice which it deserves. Though not purporting to be a text-book, it nevertheless is a book which may well serve the purpose in the

real sense of the word. In the first place are set forth in simple language and lucid style the fundamental facts of plant physiology and morphology. Although not elementary in its treatment, the book is one which the beginner may read with interest and profit. In the second place the general order in which the subjects are taken is the logical one from the teacher's standpoint.

In Part I. the author discusses the structures and functions of typical plant organs as found in the leaf, root, stem, flower, etc. Though the order of subjects in the first part is not the most advantageous, from the reviewer's standpoint, the relations of structure and function and the relation of the work of one organ to that of another is made clear, and one is acquainted with the business of a vegetable organism, and the nature of plant life, before taking up the study of the structure and relationships of the groups which form the substance of Part II.

In the second part we are introduced to the principal divisions of the vegetable kingdom in ascending order, typical examples being discussed with sufficient fullness and clearness to set forth the salient features of their kind. Due emphasis is laid upon phylogeny and discussions of points of biological interest are plentiful. One feature of the book which adds to its interest, and which will commend it to many readers, is the repeated reference to the practical application of botanical knowledge and the relation of certain plants to economic operations.

One is pleased to observe the excellent character of the illustrations. It is a relief to see illustrations that illustrate, after some of the wretched sketches and meaningless figures that characterize several of the recent text-books of botany.

J. E. Kirkwood
Desert Botanical Laboratory,
Tucson, Arizona

India Rubber and its Manufacture, with Chapters on Gutta-percha and Balata. By Hubert L. Terry. 8vo, pp. v + 291, illustrated. New York, Van Nostrand Company. 1907. $2.00.

One may fairly say that, next to mining, the growing of rubber has of recent years been increasingly regarded as a golden path to material ease. In common with mining, the project has its risks and drawbacks, and the only safe guide to intelligent investment in both is knowledge. This the general public does not have, but many individuals desire specific information, either for the reason observed, or for the sake of general enlightenment. With regard to rubber and its manufacture, Terry's book fairly meets this need; it is for such that it has been written. Though dealing with a distinctly technical field, the author has succeeded in making a very readable book, and this is due not a little to his pleasing style, occasional prolixity to the contrary notwithstanding.

One experiences a slight feeling of disappointment in reading the first two chapters, those dealing with the history of the matter and with the botanical origin of crude rubber. It would have been justifiable to have dealt with these topics with greater liberality, and the addition of treatment at greater length of the cultural aspects of the industry would have heightened the value of the book in a marked degree. It seems to the reviewer a fair criticism that the chapter on India-rubber Plantations is a trifle pessimistic. Mr. Terry's attitude is safe, because negative. A more just statement of the legitimate attempts which are being made in Mexico to cultivate rubber trees (*Castilloa*) would have had greater merit. Sharp practises do great damage to infant industries. So much more therefore do these demand proper representation at the hands of the critic.

To be commended in this connection is the effort to point out the need for adequate conservation of the natural forests of rubber-producing trees, a problem to which our modern forestry methods have not yet reached. Science will be needed in meeting this aspect of the industry quite as much as any other. Already her face has been turned toward plantation culture, with no little success, but the inevitable struggle of man with nature has already discovered a quite handsome array of

parasitic enemies, whose energies appear to be largely concentrated upon cultivated rubber-trees. The general criticism applied to the treatment of the botanical aspect of the case appears to be justified especially, for example, to the discussion of guayule, a rubber-producing plant with which Americans are more familiar (or perhaps one should say less ignorant). This plant is of peculiar interest because of its preference for the arid conditions of the central plateau of Mexico and adjacent Texas. Indeed, any plant which offers the possibility of using the desert with economic intent may well be thought worthy of special regard. With regard to the process of manufacture of crude guayule rubber the author appears not to be fully informed, but, as the industry is comparatively new, and as a number of methods have had more or less vogue, it is naturally difficult to get exact knowledge, especially at a distance, a difficulty not reduced by the natural effort at secrecy on the part of the manufacturers.

In the discussion of the technical aspects of the rubber industry the author is distinctly at home. Though often brief and summary, he gives the gist of the matter in a very satisfactory way, and this despite the very abstruse nature of the subject. Among the topics presented, to give a brief impression of the scope of the book, are the chemical and physical properties of rubber, its vulcanization, substitutes, reclamation, and the methods of manufacture of various classes of articles from it. It will suffice here to heartily commend the way in which the numerous pertinent details have been handled, since more than a very general criticism would occupy the time of the inquirer better spent in reading the original. As to the orthography, it may be captious to say anything, especially as we (speaking as Americans) have the sympathy of Mr. Terry himself, if we take exception to the English spelling of "tyre."

We may regret that the book is but poorly illustrated, more especially in the pen-drawings of rubber plants. These are hopelessly crude, and behind the times.

FRANCIS E. LLOYD

AUBURN, ALA.

SPECIAL ARTICLES

THE ACCLIMATIZATION OF AN ALFALFA VARIETY IN MINNESOTA

THAT practically none of our many crop plants are indigenous is a matter of common knowledge. Among the numerous agencies that have been instrumental in their introduction immigrants from agricultural areas of the old world deserve more credit than they have hitherto received. Although it is likely that many introductions have been made in this manner, it is rarely possible to trace clearly the history of an individual case. The successful introduction of South American alfalfa into California, to which we owe almost exclusively the present extension of alfalfa growing in the United States, took place about 1855.

In the spring of 1857 another strain found its way into the United States, this time from Europe. In that year there came to this country from the little village of Külsheim, near Wertheim, in the Grand Duchy of Baden, a German farmer named Wendelin Grimm. Like many of his countrymen, Grimm went west, taking up a farm in Carver County, Minn.

Among the few possessions that he brought with him from his old home was a small bag containing less than twenty pounds of seed of the alfalfa or lucerne commonly cultivated in Baden. Grimm applied numerous local names to this alfalfa, but most commonly he called it "ewiger Klee" (everlasting clover) referring to its perennial nature.

This small lot of seed was the progenitor of an alfalfa industry that has existed in Carver County, Minn., for more than a generation and which is now being extended into other parts of the cold northwest.

The South American seed found a congenial soil and climate and became the basis of a farming industry whose annual product has in half a century attained a value of about $150,000,000. The European seed, on the other hand, encountered a favorable soil but a very unfavorable climate, with the result that a long period of years was required for it to become finally established. The original

Grimm alfalfa came from the valley region of Baden, which is said to be one of the warmest and most fruitful districts, not only of Germany, but of Europe; a section in which the almond, walnut and vine flourish. Hence we have in the latter case an instance of the introduction of a valuable crop by an immigrant and also an undoubted example of a high degree of acclimatization brought about by natural selection unconsciously aided by man.

The Minnesota climate is exceedingly severe and during the early years Grimm alfalfa suffered many vicissitudes. Several years ago a member of the Minnesota Agricultural Society, discussing this valuable strain, said:

> When they first commenced to plant it some of them were badly discouraged . . . but finally they made a success of it, and I attribute that success to its having acclimated itself to the country. I can remember that clover growing in this county (Carver), well I should say pretty close to forty years.

Fields between twenty and thirty years old visited by the writer during the past summer have from 10 to 50 per cent. of a stand. Hardy as the strain has become, winters of unusual severity in any particular respect carry the selective acclimatization still farther. Fields examined in the summer of 1905 had suffered considerable losses in stand from the previous winter; fully 50 per cent. of the selected Grimm plants in the nursery at the Minnesota Experiment Station were winter-killed during the same winter (1904–5), while common alfalfa was killed out almost completely.

Wendelin Grimm died eighteen years ago, hence exact details as to his experiences are lacking. Nevertheless, it is apparent that in the early years of his attempt to grow alfalfa in Minnesota he suffered many setbacks. With characteristic German persistence, realizing neither the practical nor the scientific importance of his unconscious experiment in acclimatization, he patiently saved generation after generation of seed from the plants that survived each successive winter, planting new fields to replace the deteriorated ones on his own farm, and selling his surplus seed to his neighbors. He was probably oblivious both to the difficulty of the task he had undertaken and to the great value of the result, and took as a matter of course the yearly degeneration of his stands.

The fact that in its original home in Germany this variety was called upon to bear minimum temperatures less severe than those observed at Albuquerque, N. M., shows what this German immigrant accomplished in the way of acclimatization of alfalfa in Minnesota.

The Grimm strain is one of the hardiest of which we have knowledge. A six-year-old field at Fargo, N. D., has repeatedly endured temperatures lower than 30° F. below zero. It is for this quality that it is so highly prized. It came from a climate little calculated to develop resistance to cold, and as it stands to-day it is undoubtedly the direct product of fifty-one years of perpetuation of fit and elimination of unfit individuals under climatic conditions whose rigors are unknown in Germany.

Charles J. Brand
Bureau of Plant Industry,
U. S. Department of Agriculture,
November 13, 1907

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES

The American Association for the Advancement of Science and the national scientific societies named below will meet at the Johns Hopkins University, at Baltimore, during convocation week, beginning on December 28, 1908.

American Association for the Advancement of Science.—Retiring president, Professor E. L. Nichols, Cornell University; president-elect, Professor T. C. Chamberlin, University of Chicago; permanent secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C.; general secretary, Dr. J. Paul Goode, University of Chicago.

Local Executive Committee.—William H. Welch, M.D., chairman local committee; Henry Barton Jacobs, M.D., chairman executive committee; William J. A. Bliss, secretary, Joseph S. Ames, William B. Clark, R. Brent Keyser, Eugene A. Noble, Ira Remsen, John E. Semmes, Francis A. Soper, Hugh H. Young.

Section A, Mathematics and Astronomy.—Vice-president, C. J. Keyser, Columbia University; secretary, Professor G. A. Miller, University of Illinois, Urbana, Illinois.

Section B, Physics.—Vice-president, Professor Carl E. Guthe, State University of Iowa; secretary, Professor A. D. Cole, Vassar College, Poughkeepsie, N. Y.

Section C, Chemistry.—Vice-president, Professor Louis Kahlenberg, University of Wisconsin; secretary, C. H. Herty, University of North Carolina, Chapel Hill, N. C.

Section D, Mechanical Science and Engineering.—Vice-president, Professor Geo. F. Swain, Massachusetts Institute of Technology; secretary, G. W. Bissell, Michigan Agricultural College, East Lansing, Mich.

Section E, Geology and Geography.—Vice-president, Bailey Willis, U. S. Geological Survey; secretary, F. P. Gulliver, Norwich, Conn.

Section F, Zoology.—Vice-president, Professor C. Judson Herrick, University of Chicago; secretary, Professor Morris A. Bigelow, Columbia University, New York City.

Section G, Botany.—Vice-president, Professor H. M. Richards, Columbia University; secretary, Professor H. C. Cowles, University of Chicago, Chicago, Ill.

Section H, Anthropology.—Vice-president, Professor R. S. Woodworth, Columbia University; secretary, George H. Pepper, American Museum of Natural History, New York City.

Section I, Social and Economic Science.—Vice-president, Professor W. G. Sumner, Yale University; secretary, Professor J. P. Norton, Yale University, New Haven, Conn.

Section K, Physiology and Experimental Medicine.—Vice-president, Professor Wm. H. Howell, Johns Hopkins University; secretary, Dr. Wm. J. Gies, College of Physicians and Surgeons, Columbia University, New York City.

Section L, Education.—Vice-president, Professor John Dewey, Columbia University; secretary, Professor C. R. Mann, University of Chicago, Chicago, Ill.

The American Society of Naturalists.—December 31. President, Professor D. P. Penhallow, McGill University; secretary, Dr. H. McE. Knower, The Johns Hopkins Medical School, Baltimore, Md. *Central Branch.* President, Professor R. A. Harper, University of Wisconsin; secretary, Professor Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

The American Mathematical Society.—December 30, 31. President, Professor H. S. White, Vassar College; secretary, Professor F. N. Cole, 501 West 116th St., New York City.

American Federation of Teachers of the Mathematical and Natural Sciences.—December 28, 29. President, H. W. Tyler, Boston, Mass.; secretary, Professor C. R. Mann, University of Chicago, Chicago, Ill.

The American Physical Society.—President, Professor E. L. Nichols, Cornell University; secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Chemical Society.—December 29–January 1. President, Professor Marston T. Bogert, Columbia University; secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

The Geological Society of America.—December 29, 31. President, Professor Samuel Calvin, University of Iowa; secretary, Dr. E. O. Hovey, American Museum of Natural History, New York City.

The Association of American Geographers.—January 1, 2. President, Dr. G. K. Gilbert, U. S. Geological Survey; secretary, Professor Albert P. Brigham, Colgate University, Hamilton, N. Y.

The American Society of Vertebrate Paleontologists.—December 28–30. President, Professor Richard Swan Lull, Yale University; secretary, Dr. W. D. Matthew, American Museum of Natural History, New York City.

The American Society of Biological Chemists.—December 28–30. President, Professor John J. Abel, The Johns Hopkins University; secretary, Professor William J. Gies, 437 West 59th St., New York City.

The American Physiological Society.—December 29–31. President, Professor W. H. Howell, Johns Hopkins University; secretary, Dr. Reid Hunt, Hygienic Laboratory, 25th and E Sts., N. W., Washington, D. C.

The Association of American Anatomists.—December 29–31. President, Professor J. Playfair McMurrich, University of Toronto; secretary, Professor G. Carl Huber, 1330 Hill St., Ann Arbor, Mich.

The Society of American Bacteriologists.—December 28–January 2. Vice-president, Professor H. L. Russell, University of Wisconsin; secretary, Dr. Norman MacL. Harris, University of Chicago, Chicago, Ill.

The American Society of Zoologists.—Eastern Branch, December 29–31. President, Professor William Morton Wheeler, Harvard University;

secretary, Dr. Lorande Loss Woodruff, Yale University, New Haven, Conn. *Central Branch*, December 28–30. President, Professor E. A. Birge, University of Wisconsin; acting secretary, Professor Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

The Entomological Society of America.—December 29, 30. President, Professor W. M. Wheeler, Harvard University; secretary, J. Chester Bradley, Cornell University, Ithaca, N. Y.

The Association of Economic Entomologists.—December 28, 29. President, Professor S. A. Forbes, University of Illinois; secretary, A. F. Burgess, Washington, D. C.

The Botanical Society of America.—December 29–31. President, Professor W. F. Ganong, Smith College, Northampton, Mass.; secretary, Professor D. S. Johnson, Johns Hopkins University, Baltimore, Md.

American Nature Study Society.—December 30, 31. President, Professor L. H. Bailey, Cornell University; secretary, Professor M. A. Bigelow, Teachers College, Columbia University, New York City.

Sullivant Moss Chapter.—President, Dr. T. C. Frye, Seattle, Wash.; secretary, Mr. N. L. T. Nelson, St. Louis, Mo. Address: Mrs. Annie Morrill Smith, 78 Orange St., Brooklyn, N. Y.

Wild Flower Preservation Society.—President, Professor Chas. E. Bessey; secretary, Dr. Charles Louis Pollard, New Brighton, N. Y.

The American Psychological Association.—December 29–31. President, Professor G. M. Stratton, University of California; secretary, Professor A. H. Pierce, Smith College, Northampton, Mass.

The American Philosophical Association.—December 29–31. President, Professor Hugo Münsterberg, Harvard University; secretary, Professor Frank Thilly, Cornell University, Ithaca, N. Y.

Southern Society for Philosophy and Psychology.—Convocation week. President, Professor J. MacBride Sterrett, The George Washington University; secretary, Professor Edward Franklin Buchner, The Johns Hopkins University, Baltimore, Md.

The American Anthropological Association.—December 28–January 2. President, Professor Franz Boas, Columbia University; secretary, Dr. Geo. Grant MacCurdy, Yale University, New Haven, Conn.

The American Folk-lore Society.—Week of December 28. President, Professor Roland B. Dixon, Harvard University; secretary, Dr. Alfred M. Tozzer, Harvard University, Cambridge, Mass.

SOCIETIES AND ACADEMIES

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 446th meeting was held October 17, 1908, with President Stejneger in the chair. A paper on "The Pear Thrips Problem in California" was read by Mr. A. L. Quaintance. The so-called pear thrips (*Euthrips pyri* Daniel) first came to notice in the spring of 1904 in the Santa Clara Valley in California. Since its first appearance, its injuries have constantly increased, and it has now spread to the principal deciduous-fruit growing regions in the San Francisco Bay region. The losses brought about by the pear thrips the past year have been perhaps not less than half a million dollars.

The insect was first investigated by Mr. Dudley Moulton, beginning in 1904, at that time Santa Clara County entomologist, and a fairly complete account of it was published in a bulletin from the office of the state commissioner of horticulture. The increased destructiveness of the thrips led to provision by congress for an investigation of the insect by the Bureau of Entomology, and Mr. Moulton, who in the meantime had been employed by the bureau, was assigned to the work beginning July 1, 1907, with headquarters at San José, Cal.

The pear thrips attacks various deciduous fruits, as almond, apricot, peach, prune, cherry, pear, apple, etc. The life history is briefly as follows: Early in the spring, as in late February or early March, the adult thrips begin to make their appearance from the soil, at once attacking the opening buds or blossoms, and by their feeding soon cause these to blight, literally nipping the fruit crop in the bud. Oviposition occurs soon after emergence, the eggs being placed in soft tissues, especially fruit and leaf stems or in the midribs of leaves. The young larvæ feed upon the tender tissues of the leaf or flower, requiring some three or four weeks to reach their full size. They then leave the plants and work their way below the soil from three to four or even ten to twelve inches, depending upon whether this is hard or soft, as resulting from frequent cultivations. In the soil, the thrips larvæ construct small oblong cells where they remain the balance of the season. In late fall and early winter, transformation to the pupa stage occurs, from which the adults develop, to appear above ground about the time fruit trees are beginning to bloom in the spring. There is thus but one generation each year, and the insect spends practically ten months in the ground.

The pear thrips has proved to be a very difficult insect to combat, and its practical control has not

yet been determined. The Bureau of Entomology is carrying out extensive experiments and demonstrations in spraying in the infested territory and also testing over large areas the possibility of destroying the larvæ or pupæ in the ground by cultivation or other methods of soil treatment. Of many sprays tested, a proprietary tobacco extract and a distillate emulsion have proved most efficient. Spraying must be directed largely against the larvæ feeding on the more exposed portions of the plant. Of the various fruits attacked, pears and prunes suffer worst, from the fact that the thrips are out in large numbers just when the buds of these fruits are beginning to swell, and these are promptly infested and destroyed, usually before the blossoms expand.

An abstract of a paper on "Recent Discoveries in the Natural History of Eels," by Dr. T. N. Gill, appeared in SCIENCE for December 11.

THE 447th meeting was held October 31, 1908, with President Stejneger in the chair. The evening was taken up with a discussion of the necessity for an immediate biological survey of the Isthmus of Panama, the following members taking part: The chair, Gill, Dall, Howard, Coville, Pittier, Nelson, Safford, C. D. Marsh, Bartsch and Schwartz. Insistence was made on the desirability of a survey, and since the fresh waters of the two sides of the isthmus will mingle within a year, permitting the mixture of forms from the two sides, a fresh-water survey should be begun immediately. The plan favored was that of united action on the part of the heads of governmental departments rather than dependence upon congress. The following resolution was adopted:

Realizing that the work on the Panama Canal is changing biological conditions in Panama and that the completion of the canal will enable the fresh-water faunas of the two slopes to mingle freely and that many marine animals will succeed in passing the completed canal, the Biological Society of Washington urges upon the government of the United States to make provision for a biological survey of the Isthmus of Panama.

Since the conditions will be permanently changed as soon as the canal is completed and the work can not be satisfactorily done after the completion of the canal, there is great urgency that provision for the work be made at once. Therefore be it

Resolved, That copies of this resolution, signed by the president of the society and the recording secretary, be sent to the president of the United States, the heads of the several departments concerned and the secretary of the Smithsonian Institution.

THE 448th meeting was held November 14, 1908, with President Stejneger in the chair. Dr. Hugh M. Smith exhibited a series of colored lantern slides of living fishes photographed in the wild state and in aquaria by the well-known photographer, Mr. A. Radclyffe Dugmore.

Mr. Henry Oldys presented a paper entitled "Some Deductions from the Nesting of Birds," in which he called attention to the identity of construction of the nests of closely related birds in widely separated parts of the world. Thus the American robin (*Merula migratoria*), the European blackbird (*Merula merula*) and *Merula mandarina* of China all use mud in the composition of their structures; the American kinglets and the European goldcrest build suspended nests stuccoed with lichens; and the Caprimulgidæ of America, Europe and Australia construct no nests, but lay their eggs on the bare ground. These are merely random examples; many others might be cited, such as titmice, wrens, doves, etc. The components of these different groups of birds must have been separated for thousands of years, and the fact of this resemblance of their nests indicates how little they have departed from the habits of their common ancestor. This seems on its face a strong justification of the inference that nest-building is instinctive. But various instances are recorded of radical departure from the type. The American herring gull (*Larus argentatus smithsonianus*), when the usual flimsy nests of seaweeds carelessly thrown together on the beach were persistently robbed by fishermen, abandoned their custom of ages and built substantial structures in trees forty or fifty feet from the ground; and the herons near Redwood City, Cal., from a similar cause deserted their rookery with its nests in eucalyptus trees and built on the ground far out in the marsh. Other instances of radical departure from custom were instanced by Mr. Oldys, who deduced from these examples that since birds can change their architectural customs when necessity arises, we must attribute their adherence to the ancestral type of nest to conservation rather than the mechanical operation of instinct, and hence conclude that the building of a nest is an intelligent action. In support of this contention Mr. Oldys adverted to like adherence to architectural forms on the part of man, particularly shown by less developed types. The round huts of African savages, the wigwams of Indians, and

various other examples were enumerated by the speaker as evidence that man's house building runs also in architectural grooves. Lower types of man are less capable of invention and innovation than those of greater development; and as birds are still lower in the scale, the persistence of avian architectural types for ages is not incompatible with the idea that birds' labors are not automatic, but are governed by intelligence.

Mr. Wells W. Cooke read the third paper of the program, on "The Earliest Migration Records in the United States." This will be published in *The Auk*.

M. C. Marsh,
Recording Secretary

The Philosophical Society of Washington

The 654th meeting of the society was held on November 7, 1908, Secretary Burgess presiding. The following papers were read:

An Electrical Resistance Method for the Rapid Determination of Moisture in Grain: Dr. L. J. Briggs.

The speaker briefly reviewed the lack of uniformity in grain grading due to the moisture content of the grain, and the effect of moisture upon the method of grain shipment. The methods heretofore used in ascertaining moisture content of grain were briefly described and the importance of a rapid method was pointed out. The speaker had recently applied the electric resistance method to the problem. It was found that the same specific resistance gave the same per cent. of moisture within a limit of error of 0.3 per cent. A curve was exhibited showing the relation of the percentage of moisture content to the logarithm of the electric resistance. The results showed three noteworthy things: (1) all the varieties of wheat tested in the investigation gave about the same amount of moisture for the same specific resistance; (2) the high temperature coefficient; (3) the relation of moisture content to the logarithm of the resistance.

By this method the moisture content can be ascertained in about one half hour, whereas by the methods heretofore usually employed three days were required.

The paper was published in the issue of Science for December 4.

Some New Measurements with the Gas Thermometer: Dr. A. L. Day.

This paper will be found published in full in the *American Journal of Science* for November, 1908.

R. L. Faris,
Secretary

The American Chemical Society
Northeastern Section

The eighty-seventh regular meeting of the Northeastern Section of the American Chemical Society was held on Friday, November 20, 1908, at the Technology Union, Boston. Reports of the treasurer and secretary for the year just closed showed the section to be in prosperous condition. The annual election was held and the following officers chosen for next year:

President—G. N. Lewis.
Vice-president—Franklin C. Robinson.
Secretary—Kenneth L. Mark.
Treasurer—Hermann C. Lythgoe.
Councilors—J. F. Norris, W. H. Walker, L. A. Olney.
Executive Committee—S. W. Wilder, Karl Langenbeck, W. L. Jennings, F. E. Gallagher, A. G. Woodman.

Professor Henry Fay, of the Massachusetts Institute of Technology, addressed the section upon "The Effect of Manganese Sulphide upon Steel," having particular reference to the failure of steel rails. The appearance and properties of manganese sulphide in steel were discussed and it was shown that under certain conditions this substance may cause dangerous weakening of the finished rail. The relation of this material to fractures which had occurred in rails in use was clearly shown by an interesting set of lantern-slide photographs. The properties of manganese sulphide were studied and its melting point found to be 1,162° C., and its specific gravity after fusion, 3.966. It was suggested that in consequence of the difference of its specific gravity, and that of steel, better separation of the sulphide may be obtained by keeping the melted metal in the ladle for a longer time after adding the ferromanganese, and before pouring the ingot.

Professor Franklin C. Robinson, of Bowdoin College, addressed the section upon "Some Chemical Facts and Fancies." The speaker related numerous personal experiences as an expert on the witness stand, and advanced certain views as to the proper attitude of the expert in court trials, particularly in criminal cases. He especially deprecated the theatrical or pompous attitude, sometimes assumed by the expert, and asserted that usually a better impression is made upon the court and the jury if the witness keeps himself somewhat in the background.

Frank H. Thorp,
Secretary